

DISEASES OF THE LUNGS

FROM

MECHANICAL CAUSES;

AND

INQUIRIES INTO THE CONDITION OF THE ARTISANS
EXPOSED TO THE INHALATION OF DUST.

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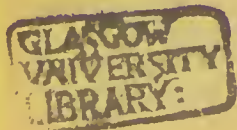
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INTRODUCTION.

THE following pages are introduced to the public, in the hope that they will excite attention proportionate to the evils described, and which it is the anxious desire of the writer to meliorate. Small as the work is, it has been the labour of years. The inquiry was commenced in 1837, and, with few interruptions, has been steadily pursued until the present moment. He has been encouraged to persevere in the undertaking, from the strong conviction, and the admitted fact, that the evils are not necessarily associated with the occupation, but are the offspring of changes induced by the extension of manufactures. Had he had any doubts on the practicability of the correction of them, either from the expense that would be incurred, or from any other cause, he certainly would not have devoted either his time or money in the accomplishment of a task, that could serve no end, except to excite useless sympathy.

It is demonstrated by the clearest possible evidence, that where the system of ventilation proposed has been adopted, the dust is entirely removed, and the appalling diseases of the lungs, which would otherwise have been produced, are unknown. The grinders are much more numerous than any other class of artisans in this town. As far as the inquiries of the writer have enabled him to form an opinion, they are not less than 3000; and the individuals dependent upon them for support, at a moderate estimate, are 9000. It is, therefore, manifest, that the severe and long-protracted disease of the grinder, by which he is early incapacitated from labour, or compelled to pursue it, a miserable and painful object, and at length his premature death, are circumstances which affect the social condition of a large and important section of the population.

It will also be obvious, from the various facts brought under consideration, that the evils must in various ways be felt by every portion of the community. Vice, ignorance, and destitution, exert a widely pervading influence. The inability of the artisan to continue his occupation from disease, throws him, and, perhaps, a numerous family, upon the parish for support, not in a few solitary cases, but in hundreds of instances; and it is scarcely necessary to observe, that on his death, the same dependence, if not indeed in an aggravated form, becomes indispensable for years. When the parish is not burdened in this stage of suffering, the injury to society, from the inadequate struggles of the afflicted artisan to live, is scarcely in any degree mitigated. The children, without having received any education at all, are put to work, at seven, eight, and nine years old, from which circumstances, and the fruitful consequences which flow from them, in a later stage, additional claims upon the parish funds are created, or ignorance and immorality extend, maintaining low and depraved habits of feeling among the labouring classes.

The writer takes this opportunity of thanking the public press generally, for the manner in which it has spoken of his inquiries into the condition of the artisans of this town,¹ and especially for the warm expressions of sympathy towards the most neglected portion of them. He trusts, that on the present occasion, his labours in relation to this particular and extensive class of artisans, will meet with the same kind reception, and by the able exposition of the evils, facilitate the object which he has in view—the correction of them.

It is, perhaps, scarcely necessary to remark, as the fact is generally known, that this small work has appeared, within the present year, in a series of papers, in the *London and Edinburgh Monthly Journal of Medical Science*. This course was adopted, in order that the evils exposed might be widely known; and for this facility, which was courteously accorded to his wishes, the writer takes this opportunity of thanking the spirited and talented editor of the Journal.

¹ The Vital Statistics of Sheffield.

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ON

DISEASES OF THE LUNGS

FROM

MECHANICAL CAUSES.

CHAPTER I.

THE CIRCUMSTANCES IN WHICH THE DISEASE OCCURS.

EVERY locality in which manufactures are extensively carried on, offers to the medical inquirer a valuable field for study. Morbid effects present themselves in connection with particular circumstances; hence important modifications arise in the character of the symptoms evolved, and corresponding changes in the remedial measures are necessary to be employed. The more diversified the aspects in which any disease is investigated, the more accurate and comprehensive are the pathological views resulting, and the greater is the command of the resources of art. Every new relation which is brought under notice, is a new point of observation, and enables the mind to take a wider survey of the operations of the animal system.

There is, perhaps, no town in the united empire in which thoracic diseases prevail to so great an extent, among a large class of artisans, as in Sheffield. Grinding the various articles of cutlery and hardware, as we shall shortly explain, is an occupation peculiarly destructive to human life. The instances of suffering are not few or occasional, but numerous and constantly produced

by the unmitigated evils of the occupation. Every practitioner here is more or less familiar with the disease induced; it is brought almost daily under his consideration.

We have therefore the advantage of a locality rich in subjects bearing on the proposed undertaking, and circumstances have concurred in presenting peculiar facilities for the prosecution of it. From our being attached as physician to the General Infirmary of the town for eleven years, many cases have necessarily fallen under our observation; and having enjoyed, for a considerable period, the valuable instructions of Laennec, we were not altogether unprepared to enter upon the investigation. For several years we have steadily and with few interruptions, studied the circumstances by which the social, physical, and mental condition of the grinders is influenced. On the present occasion, however, we shall confine our researches to the character of the morbid changes induced, and the consideration of the remedies by which they may be relieved.

Grinding, on an extensive scale, is almost peculiar to this town and neighbourhood. Their principal productions, cutlery and edge-tools, immense in amount, are all ground either upon a dry or a wet stone. Many articles are ground upon both, on the dry first, and on the wet one afterwards; a few, as saws and scythes, on the wet stone only. The injurious effects of the occupation belong particularly to dry grinding, and the evils which it produces are comparatively of modern origin. Previous to the employment of steam as a propulsive power, all grinding wheels were situated on the rivers in the neighbourhood, at a distance varying from two to five miles, and in the midst of scenery exquisitely picturesque and beautiful. The consequence was, that, whether the grinder were resident in the country or the town, he had the advantage of an abundance of fresh air and daily exercise. Besides these circumstances, which are well calculated to preserve the animal system in health, he had frequent holidays, from the supply of water being either too great or too small, so that his application was less continuous than under the new system, which has none of these interruptions. At that time dry grinding was almost unknown. The introduction of it has been owing to the gradual diminution in the scale of wages. The one process is much more expeditious than the other, and is now ex-

tensively employed. If not judiciously used, it injures the temper of the article.

The modern grinding wheels are built in the town, and are several stories in height, and no regard whatever has been given to the ventilation of them. Each room is occupied by eight or ten individuals belonging to different branches. In former times, the wheels were well ventilated by dilapidated roofs, shattered doors, and broken windows; but in the recent structures, these natural means are carefully guarded against, so that the clouds of dust which rise from the stone, envelope the grinder, and continue to play round his head. The respiration is continually disturbed by the inhalation of the numerous floating particles of stone and metal.

The increased frequency of pulmonary disease in this class of artisans, is principally to be ascribed to the general introduction of dry grinding, and the less ventilation secured by the expensive structures of modern times. Wheels are now erected at the cost of ten or twenty thousand pounds, and in situations where land is valuable; hence the consideration to economise space, to the certain destruction of the health of the grinder.

In studying the evils arising from the occupation, it is necessary to make a few remarks on the habits of the workmen. There is much that may be said in extenuation of their dissipation and ignorance. In most of the branches, children from nine to twelve years of age can be made useful, and unfortunately are frequently employed without any previous education. The extremes of commercial prosperity and adversity are, perhaps, equally injurious to the moral and mental condition of the artisans. When trade is good and wages high, they are apt to spend much time in drinking and sensual enjoyments, deriving the means of indulgence from their children or apprentices. In a period of depression, diminished labour and depreciated wages are accompanied with great suffering—far greater to the grinder than to any other class of workmen. His expenses of wheel-room, independently of house-rent, are from eight to sixteen pounds per annum, and remain the same in all conditions of trade. At the present moment, wretchedness prevails to an awful extent. The injurious effects of the occupation are greatly aggravated by poverty, over-exertion, and dissipation. ✓

In the grinding of small articles, as needles, pen-knives, scissors, razors, and forks, the amount of dust evolved exceeds that of every other branch, and the consequent results, wretchedness and premature death, are appalling to contemplate. In these branches, the face of the grinder is necessarily within a few inches of the stone, so that it is quite impossible to avoid the inhalation of the dust created. A stranger entering the rooms at certain times, would find it difficult to breathe in them.

The dust is composed both of gritty and metallic matter, and in needle-grinding, the concrete masses of it which are formed, have almost the specific gravity of iron.

CHAPTER II.

THE ACTION OF THE INHALED NOXIOUS PARTICLES ON THE RESPIRATORY ORGANS.

We are not aware that any previous inquirer, who had ample opportunities of investigation, has entered fully into the consideration of the manner in which pulmonary disease is induced by the inhalation of gritty and metallic particles. The subject has been slightly touched upon by several writers, to whose opinions we shall briefly allude.

In consulting the labours of Ramazzini and Patissier, it is singular to observe, that both, in treating of the evils arising from the grinding of articles of cutlery, and the pointing of needles, do not even allude to the tendency to pulmonary disease from the injurious nature of the occupation. The dust which is evolved is stated to be detrimental to the eyes, and the artizans are said to be liable to accidents from the breaking of the stones on which they work. The following extract embodies the whole of their remarks on needle-grinding—a pursuit which is fraught with greater misery and wretchedness to the workmen, than any other springing out of the habits of civilized society.

“ A Aix-la-Chapelle on fait des aiguilles par soixante-treize opérations différentes: une de ces opérations a pour objet de faire des pointes, et l'on y parvient en présentant à la fois, sur une meule, un assez grand nombre de ces aiguilles, que les ouvriers, avec beaucoup d'adresse, font mouvoir circulairement dans une de leurs mains. Cette opération est dangereuse, 1^o. Parce qu'il s'échappe des portions imperceptibles de la meule ou de la matière qu'on lui présente, et que lorsqu'elles atteignent les yeux des ouvriers, ils les perdent dans de cruelles douleurs. C'est pour se préserver de cet accident qu'ils portent des lunettes. 2^o. Les meules peuvent si briser et tuer les ouvriers; ces explosions sont attribuées à des fentes presque imperceptibles qui se trouvent dans les meules et dans lesquelles l'air s'introduit, et à la rapidité de la rotation.”¹

If either writer had been practically acquainted with needle grinding, on a scale sufficiently ample to exhibit the general tendency of it, the occasional maladies of the eye would have been disregarded in consideration of the far more frequent and severe diseases of the lungs. So common and appalling are the latter, that our attention has scarcely for a moment been directed to the former. The work of Ramazzini, with additions by Patissier, is of considerable merit, especially when the period at which it was written is taken into consideration. In many important respects, however, it is unsatisfactory; and, if taken as a guide, will often lead to superficial views and erroneous conclusions. The work is behind the wants of the age, rich in the occasions by which they may be supplied.

The effects of dust evolved in stone-cutting are treated at some length in it, and with much truth.

“ La poussière qui se détache des pierres pénètre par la bouche dans les poumons, s'arrête dans les voies respiratoires, se mêle aux mucosités dont ces organes sont lubrifiés, et forme parfois de vrais calculs, qui donnent naissance à la toux, aux hémoptysies, et peuvent même occasioner des pleurésies, des péripneumonies dangereuses. M. Clozier a observé que les ouvriers qui taillent le grès sont plus sujets aux fluxions de poitrine que les autres hommes exposés à des travaux rudes et violens. Ces maladies dégé-

¹ Patissier, *Traité des Maladies des Artisans*, p. 355.

nèrent le plus souvent en phthisies qui amènent la mort lentement.”¹

Deslandes, the most recent writer on the subject, alluding to various medical authorities, treating of the diseases occasioned by the inhalation of gritty and metallic particles, remarks:—

“ Ces faits m’ont été confirmés par plusieurs maîtres-polisseurs de Paris. Ils s’accordent à dire que leurs ouvriers ont, en général, les yeux rouges, quand ils viennent de travailler, sans pour cela être plus que d’autres sujets aux opthalmies; que le polissage leur laisse une âcreté, une saveur métallique dans l’arrière-bouche; que bientôt ils deviennent maigres, pâles; qu’ils ont habituellement soif; que leur peau est sèche; qu’ils ont une petite toux habituelle, sont sujets à cracher le sang, qu’ils ne dépassent guère 36 à 40 ans, et qu’on les regarde comme vieux quand ils vont jusqu’à 45.”²

The writer does not appear to speak from extensive personal observation. His opinions rest on the sentiments or researches of others, and, in evidence of this, we should adduce the following passage:—

“ Long-temps les matières crétacées que l’on rencontre dans le voisinage des bronches et même les tubercles des poumons, ont été attribués à des agglomérations, et même à l’absorption de molécules pulverulentes. Cette opinion ne mérite plus aujourd’hui qu’on s’arrête pour la réfuter. Quant au séjour des poussières dans les voies aériennes, il y a lieu de penser, avec Lænnec, que le plus souvent, il doit être fort court.”³

An intelligent friend⁴ published, in 1830, two papers on the grinders’ disease, which deservedly excited attention. They treat, however, very briefly the action of the inspired dust as well as the pathology of the malady. The prejudices of the workmen, at the time when he prosecuted his researches, did not allow him to do full justice to the inquiry. Our labours have been pursued under more favourable circumstances, and have occupied a large portion of our attention for years. In discussing the action of the exciting cause, this writer remarks:—

“ The cause, the symptoms, the treatment, and the result of

¹ Patissier, *Traité des Maladies des Artisans*, pp. 96, 97.

² *Dictionnaire de Médecine et de Chirurgie Pratiques*, pp. 572, 573. ³ *Ibid.* p. 575.

⁴ Sir Arnold James Knight, M.D.

the grinders' asthma, leave little doubt as to the precise nature of the disease, still it must be regretted that its pathology has not been confirmed by that demonstrative evidence which *post mortem* examinations alone can supply. We are thus compelled to infer the morbid anatomy from the symptoms, instead of explaining the symptoms from the ascertained alterations of structure. The part of the respiratory system to which the particles of dust are first applied, the hoarseness of the voice, the thickening and tenderness about the larynx and trachea, the wheezing and sense of constriction about the upper part of the sternum, the hoarse dry cough, the relief obtained from medicines adapted to affections of the bronchial membrane, and the tendency of the disease to end in tracheal consumption: all these symptoms point out the mucous membrane of the air-passages as the original and principal seat of the grinders' asthma. So long as the mucous membrane retains its integrity, the grinder experiences little inconvenience from his trade; the irritating particles are either immediately expelled, or are rendered harmless by being inviscated in mucus; long-continued irritation, however, lessens its sensibility, and impairs its secretion; then the dust accumulates in the bronchial tubes, and, lying in contact with the mucous membrane, not so well defended as formerly, inflames and thickens it; the mucous tissue being thus permanently thickened, a state of constant dyspnoea is induced."¹

Dr Hodgkin in his recent and excellent work, *Lectures on the Morbid Anatomy of the Serous and Mucous Membranes*, (vol. ii. part i. page 212,) thus expresses himself:—

“An idea has been advanced, that earthy collections in the lungs are sometimes produced by the inhalation of impalpably fine dust, to which some persons are by their occupations exposed; and the workmen of the quarries of Montmartre have been cited as instances of this fact. Although there can be no doubt that the inhalation of the atmosphere, highly charged with mineral particles, however minute, must be a highly deleterious source of irritation, and, consequently, be very liable to become a fruitful cause of those affections which I have mentioned, as producing calculi in the lungs; yet it appears extremely un-

¹ North of England Medical and Surgical Journal, vol. i. pp. 174, 175.

likely that, under ordinary circumstances, the earthy particles should either penetrate profoundly into the substance of the lung, or be so partially collected as to form concretions. It is more probable that they would be arrested by the mucus of the air-passages, and voided by the efforts at expectoration, excited by the irritation which they induce."

It is exceedingly difficult to trace the first morbid effects arising from constantly breathing an atmosphere surcharged with gritty and metallic particles. We have seldom or never observed any acute inflammatory action caused by it in the young; and, at a later period of life, the symptoms are chronic in character. It is remarkable how little the respiratory organs seem to suffer, even for years. The earliest inconveniences experienced, are occasional irritation in the larynx and trachea, exciting cough, and slight expectoration, which is saliva coloured with the inhaled dust, and is sometimes quite black: a dryness of the throat, also, generally exists. The attention of the artisan is rarely awakened by these circumstances. They do not perceptibly disturb any of the functions of the system. The appetite and the digestive powers are in no degree affected. These symptoms sometimes continue for several years without any serious aggravation.

The first effect of the dust, is to cause an increased action in the mucous membrane of the trachea and bronchial tubes; in consequence of which expectoration is excited, presenting nothing peculiar in its character. In some cases, where the constitution is defective in tone and vigour, showing a scrofulous or leucophlegmatic tendency, the expectoration soon loses the condition of simple saliva, and purulent-like matter is observed mixed with the inhaled dust.

The constant irritation of the mucous membrane of the trachea and bronchi, will necessarily modify the natural conditions of it, but to a less degree than would be anticipated from a knowledge of the circumstances in which the individual is placed. Every part of the animal economy struggles to throw off that which is injurious to it; and adapts itself, in a remarkable manner, to a state of things that would appear incompatible with life. This interesting fact is illustrated by the mucous membrane in the instance of the grinder. It gradually loses its natural sensibility, so that the inhalation of dust, though baneful in the ex-

treme to the whole of the respiratory organs, is modified in its influence by the diminished susceptibility of the delicate secreting surface. It must not be imagined, however, from these remarks, that the trachea and bronchia are not frequently the seat of serious morbid changes. They are less so, indeed, than would be anticipated from the constant action of the exciting cause. When it is considered that the grinder, in most of the branches, is constantly breathing, during the hours of labour, an atmosphere loaded with dust created either by himself or others, extensive structural modifications in the air-passages would be regarded, and justly, as inevitable consequences. The mischief is by no means confined to them. We conceive that the fine particles are often conveyed through the minute bronchial ramifications to the lungs, giving rise to structural alterations, by which the breathing capacity of these organs is diminished. Writers generally on this subject are opposed to such transmission, and look upon the action of the dust, as limited to the numerous air-tubes; and believe, further, that the dust is always removed by the secretions of the mucous membrane. In either of these conclusions we cannot concur.

There is an important distinction between the circumstances of the grinder and stone-cutter, who is also liable to pulmonary disease from a similar cause. The former is exposed to ten times the amount of dust that the latter is, the particles of which are likewise much finer. The phthisis of the stone-cutter results principally from the irritation of the air-passages. In the descriptions of the old writers of the effects of such occupation on the lungs, in which the dust was found accumulated in the bronchia and air-cells, the sufferers, we presume, though the fact is not always stated, were workers in marble, and not in common stone. In the former, the particles of matter evolved would, in certain parts of the process, be as impalpable as in dry-grinding; consequently, an approximation in the similarity of the influence exercised by them. In stone-cutting, the dust is much less likely to be carried along with the air through the endless divisions of the bronchia. We do not doubt the fact, but the frequency of the occurrence, in comparison with what takes place in the grinder, working in a close room, and in an atmosphere clouded with dust. It is impossible to con-

ceive how, in the ordinary process of respiration, the finest parts of it should not be conveyed into the substance of the lungs. There is nothing in the structure of these organs to prevent it. The difficulty of breathing which is sometimes observed, unaccompanied with obvious disease of the lungs, and continuing only for a short time in an aggravated form, (of which we have seen many instances,) arises, we imagine, from the inspired dust lessening the capacity of these organs. The respiration is relieved by expectoration, which, in these cases, is always sputa either of a brownish cast, or not unfrequently quite black, and gritty in its nature. We are aware that expectoration, independently of its qualities, is capable of affording relief. The colour and character of the expectorated matter establish the inhalation of dust, and, in numerous instances, the fact, that it has long existed in the respiratory organs. The minute ramifications of the bronchia and air-cells become clogged with it, interrupting the free ingress of air; hence the laborious respiration, and the marked benefit which results from expectoration.

High medical authorities have treated with contempt the results which have frequently been stated to be produced by the inhalation of dust. One of the most distinguished of modern times, Laennec, is of this number. The strangeness of his opinions can arise only from not having enjoyed ample opportunities of investigating the matter, on which he presumed to express a decided opinion.

“On trouve,” he remarks, “dans la plupart des pathologistes des opinions assez singulières sur la cause et l’origine des concrétions osseuses crétacées du poulmon. J’examinerai seulement celles qui sont le plus précieuses, ou qui ont été émises par des hommes dont le nom fait le plus autorité. Cullen, après beaucoup d’autres, les regarde comme une cause fréquente de l’asthme, et pense qu’elles peuvent être dues aux émanations pulvérulentes mêlées dans l’air, et que respirent habituellement les hommes voués à certaines professions, comme les amidoniers, les lapidaires, les chauxfourniers, les voituriers, etc.

“La nature chimique des concrétions dont il s’agit, mieux connue depuis les belles analyses de Scheele, rend aujourd’hui cette étiologie ridicule, quoiqu’elle ait été long-temps universellement adoptée, et dispense de la réfuter.

“ Je n’entends pas nier, d’ailleurs, qu’une certaine quantité de poussière introduite chaque jour dans les bronches avec l’air que l’on respire ne puisse occasioner une dyspnée momentanée, et à la longue, peut-être, devenir la cause occasionnelle d’une maladie quelconque du poumon; mais le séjour de cette espèce de corps étrangers dans les bronches n’est jamais très-long, et il suffit d’examiner l’expectoration d’un homme qui a passé la nuit dans une atmosphère épaissée par la fumée d’une lampe, ou la journée sur une grande route couverte de tourbillons de poussière, pour se convaincre que dans l’espace de vingt-quatre heures ces corps étrangers sont expulsés à l’aide du mucus bronchique qui les enveloppe.

“ Si d’ailleurs, ils pouvaient séjourner dans le poumon, ce serait sans doute dans les bronches qu’ils s’accumuleraient, et on y trouverait un amas considérable de matières diverses suivant la nature des émanations au milieu desquelles vivrait le malade; or, cela ne s’est jamais vu, que je sache; et pour mon compte, je n’ai rencontré rien de semblable, quoique j’aie ouvert les corps d’un grand nombre d’individus qui avaient passés leur vie dans des ateliers dont l’atmosphère est continuellement chargée de poussières calcaires ou autres.”¹

It is manifest that this distinguished pathologist had possessed few opportunities of studying the morbid effects produced by the inhalation of dust, under circumstances exceedingly aggravated in character. Had his sphere of observation been enlarged, his conclusions, we have no hesitation in stating, would have been very different. It is seldom that the metropolis of any country offers frequent occasions for investigating the influence of important branches of manufacture on the human constitution. To observe these in their variety and activity, and to appreciate justly the tendency with which they are fraught, the inquirer must be long resident in the provinces, where only they can be studied with advantage, and in connection with many modifying circumstances. The position of Laennec did not present these peculiar facilities, consequently his remarks on the inhalation of dust, though coming from one unrivalled as a pathologist, are

¹ *L’Auscultation Médiante, &c.* Tom. i. p. 232.

entitled to no more respect than the limited evidence on which they rest.

In treating of the influence of gritty and metallic particles on the respiratory organs, there are two important structural changes to which they give rise,—to which no writer has ever alluded,—*an enlargement of the bronchial tubes, and an expansion of the pulmonary tissue.* These are not invariable effects, but they are produced in an immense number of instances, as we shall subsequently endeavour to prove; and the production of them, though accompanied with serious symptoms, distressing cough, and difficulty of breathing, are, nevertheless, more favourable to the prolongation of life, than the absence of them in the artisan, suffering from other morbid conditions, induced by the inhalation of such particles. The great mortality among grinders is from 21 to 35 years of age. The delicate in constitution, and the wretched in circumstances, break up long before the latter period, of degeneration of the lungs, presenting the ordinary symptoms of tuberculous phthisis. With very limited exceptions, the few who live beyond 35 years of age,—in the most deleterious branches of grinding,—live in consequence of these structural changes, or, in language unexceptionable in this stage of the inquiry, they exhibit the symptoms by which they are characterized.

When the constitution is vigorous, and the individual possesses a well-developed chest, the injurious influence of the dust is, to a great extent, confined to the production of bronchial irritation, at least for a considerable period, the result of which is a frequent and severe cough, existing for several years, unaccompanied with any morbid derangement of the animal economy. The pulse is slightly, if at all, accelerated; nor do we observe any fever or disturbance of the digestive powers. The continuance of the cough excites little anxiety in the artisan, interfering in no degree with his daily occupations. At length, however, he complains of difficulty of breathing, and which is aggravated on every exertion, whether of walking or coughing, and then he is regarded, by himself and others, as attacked with asthma,—a term which is almost universally employed here to designate his symptoms. This form of disease is no *certain* protection against the inroads of further pulmonary degeneration, as tubercles,

hepatization, or any other structural change. The enlargement of the bronchial tubes, on which it would appear chiefly, if not exclusively, to depend, affords, nevertheless, to an important degree, such protection; and the longest-lived among the diseased grinders, by many years, are found in the asthmatic class.

The dust, in many cases, seems to affect directly the substance of the lungs, causing little irritation in the air-passages. We were recently consulted by a needle-grinder, thirty years of age, who had been incapacitated from labour about two years. He had had little cough previously to his accelerated breathing, and he had scarcely any when we saw him, except an exceedingly short cough on exertion. His pulse was small, and about 80; no heat of skin, fever, nor perspirations; had lost little, if any flesh; nor was he suffering from any pain whatever. The tongue was natural in appearance; the respiration was, to a considerable extent, abdominal in character. On examining the chest, this was observed to rise and fall as if it were an entire mass. On percussion an extremely dull sound was heard over the whole of the right side, and only a few degrees less so on the left. Scarcely the slightest respiratory murmur was detected in the right lung, and faintly in the left.

In order to test the capacity of the lungs, he was requested to repeat a series of numerals; he seldom, however, could go beyond five, without the necessity of an inspiration. As long as he remained perfectly quiet, there was nothing in his appearance, except to the practised eye of the medical observer, that indicated the invalid. A case like this has seldom fallen under our observation, presenting extensive mischief in the lungs, associated with the smallest possible amount of breathing capacity compatible with the continuance of life; and yet the absence of various symptoms of constitutional disorder, which almost invariably manifest themselves under such circumstances.

The origin of tubercles is involved in much obscurity, and great discrepancy prevails among writers concerning the circumstances imagined necessary to their production. By some, inflammation is regarded as the cause; by others, they are viewed as peculiar morbid structures, independent of inflammation. Some recent pathologists, whose opinions have much to recommend them to an elaborate consideration, conceive tubercles to

be a secretion. Into these questions it is not our business, on the present occasion, to enter. Our object is to state facts, or certain circumstances in association with phthisis, occurring on an extensive scale. Whatever may be the cause of tubercles, they are found in numerous cases in the lungs of grinders, and can be traced to the inhalation of dust; hence irritation, or some degree of inflammatory action, would appear to be a fruitful source of them. The inspired dust conveyed to the lungs must produce some immediate effect on the delicately organised structure, rich in the supply of blood; and what effect is so probable as a species of local inflammation, so slow in its progress, and so insidious and masked in its character, as to give rise to no constitutional symptoms? The dust is the cause of inflammation in the larynx, the trachea, and the bronchial tubes; and as a foreign substance, it must excite a morbid action with whatever part of the animal economy it comes in contact. Why tubercles should be the result, and not other conditions of inflammation, it is not in our power to assign a satisfactory reason. The fact is obvious and unquestionable, and the occurrence of tubercles under such circumstances is so general, that we cannot bring to our aid a constitutional predisposition.

The grinders, who die of consumption, frequently exhibit traces of active inflammation in some of the organs of the chest. In some, the pericardium is thickened and adherent to the heart. The most common effects observed, are strong attachments between the pleura of the lungs and the internal surface of the thorax. In some instances they are exceedingly firm, formed by strong bands of effused lymph, several lines in thickness. The history of the cases seldom affords any accurate information respecting the origin of such changes. The inspired dust can scarcely be imagined as directly instrumental in the production of them. The class of artisans in which they occur are extremely liable to inflammations, from the wretched condition to which they are often reduced by want and suffering, by the nature of their pursuits, and the irregularity of their habits.

Though far from disposed to underrate the injurious effects of the dust on the larynx, the trachea, and the bronchial tubes, the consideration of the subject leads us to attach equal, if not greater importance to the structural modifications directly induced in

the substance of the lungs by the action of the dust—a conclusion which is at variance with the opinions of most who have had practical opportunities of studying the subject. We admit most freely the serious morbid changes which often take place in the mucous membrane of the trachea and the bronchial tubes, and also the influence which they will necessarily exert on the condition of the lungs; we contend, however, that the direct action of the dust on these organs has not received sufficient attention.

The disease occurring amongst this class of artisans is usually designated “Grinders’ Asthma,” and by writers who imagine the dust to cause extensive structural modifications in the mucous membrane of the air-passages. As a term descriptive of the morbid phenomena produced by the inhalation of gritty and metallic particles, it is objectionable. It very inadequately conveys to others the character of these phenomena. They are not simply uneasy breathing, cough, and expectoration, but these symptoms, in the cases which approximate in their broad outline to asthma, and frequently, if not generally, in addition, important structural changes in the lungs and the air-passages. In an immense number of cases which come under observation, we do not perceive the phenomena of asthma, but of tuberculous phthisis; and, though modified by the circumstances of the individual, and the peculiarity of the exciting cause, the symptoms are manifestly those of pulmonary degeneration, and can be fitly designated only by a term expressive of this condition. No single term is sufficient to describe the variety of morbid results produced by the inhalation of dust. Our duty is to bring under consideration the symptoms evolved in the different stages of the disease, and leave them to suggest the name by which they can be most appropriately classified.

CHAPTER III.

MODIFICATIONS IN THE CHARACTER OF PHTHISIS FROM A DIFFERENCE IN
THE CIRCUMSTANCES IN WHICH IT OCCURS.

In studying the morbid effects induced by the inhalation of dust, the attention has frequently been arrested by differences in the progress and symptoms of consumption, from what is usually observed in ordinary circumstances. The physiologist would expect, that a structural alteration in the condition of the lungs, arising from an external irritating cause, would be evolved in association with constitutional energies, very unlike what exist, when such alteration is the result of unknown vital actions. In this case, the morbid change belongs not to the lungs only, but to the whole of the animal system.

In endeavouring to describe, in few words, the prominent and general symptoms of phthisis, as it occurs from constitutional tendencies, we shall confine ourselves to such phenomena as are familiar to every professional observer, and which are simply necessary, as data, for the comparison which it is proposed to institute.

The contemplation of certain peculiarities, in connection with the progress of disease in grinders, has frequently suggested to the mind the ingenious remarks of a philosophical inquirer,¹ concerning the influence of disease, seated in different organs, *on the vital powers generally*. The subject is well worthy of the consideration of the practical and enlightened inquirer, but would be found fraught with serious difficulties. Mason Good, after stating the ingenious opinions of Dr Pemberton, says,—“Are the lungs to be regarded as an organ of waste, or of supply? The question may be answered in opposite ways, according to the hypothesis adopted respecting the doctrine of respiration. They throw off carbonic acid gas. Do they introduce oxygen, or any

¹ Dr Pemberton.

other vital gas into the circulating system? As an organ of waste, we cannot, upon the principle here laid down, account for the emaciation which flows from a diseased condition of them. If it can be substantiated that they are an organ of supply, they confirm and extend the principle. Will this principle, moreover, apply in dropsy, in which there is even more emaciation than in phthisis? The subject is worth elucidating; but we have not space for it, and must proceed to arrange the four species that appertain to the genus before us."¹

Without presuming to speculate on the interesting question here brought under notice, we may remark, that, according to the ideas of Dr Pemberton, the lungs, in phthisis arising from constitutional tendencies, would seem to exert an extraordinary influence on the animal economy. The whole frame gradually loses its tone and vigour, and the waste of the body increases with the progress of the pulmonary affection. Such correspondence between the march of the disease and the decay of the vital powers, would appear, on a slight consideration, to establish the vast influence of the lungs, under these circumstances. It is impossible to question the connection between the two, as cause and effect, to a certain extent, in the series of morbid changes evolved; but we must confess, that the study of the disease, when arising from the inhalation of dust, tends very much to qualify the adoption of this opinion.

There is a marked difference in the influence of the lungs in phthisis, induced by mechanical causes, and that originating in the natural predisposition of the body. In the one case, the local disease springs out of a morbid condition of the animal system generally, and, in the other, is associated with vital powers possessing considerable energy. Such, indeed, is the broad distinction between the two, and which would be anticipated from a very general acquaintance with the history of the two cases. Where the disease is constitutional, the first steps of morbid action are seldom, if ever, detected by the patient, or the acute medical observer. They occasion no pain or inconvenience, nor are they accompanied by any perceptible change in the appearance of the individual. When the first unequivocal symptoms show themselves, or rather when they excite a strong suspicion

¹ Study of Medicine, by John Mason Good, vol. ii. p. 712, edit. 1822.

of their nature in the mind of the physician, though even then no source of anxiety or suffering to the patient, the general expression of the frame, to the experienced eye, indicates a certain degree of attenuation. It is usually most obvious about the neck and chest, simply because these parts are the most open to observation. Every degree of aggravation in the symptoms of the disease is always accompanied by increased wasting, and the bodily decay is one of the significant phenomena of constitutional tuberculous phthisis, and, according to the ingenious views of Dr Pemberton, might be adduced in illustration of the influence of the lungs in disease. We question not, as already remarked, the connection, as cause and effect, in such cases, in a modified degree, but contend, *that the pulmonary affection springs out of a condition of the animal system, prone to deterioration and decay*; and that this condition is, in our opinion, more frequently a cause than an effect of the local malady, whether this be seated in the lungs, the kidneys, or any important gland or series of glands. Where the constitution is peculiarly predisposed to this disease, the powers of life are quickly exhausted: where the constitution possesses properties less favourable to the inroads of debility, the pulmonary degeneration advances slowly, or is frequently arrested for years. Such diversities in the progress of phthisis are familiar to every practitioner. We question whether the importance of invigorating the vital powers, when the early symptoms admit of it, is sufficiently kept in view.

In the artisans exposed to the influence of gritty and metallic particles, the predisposition to the pulmonary affection can only be an occasional concomitant; therefore, the vital powers, so far from accelerating the progress of the local disease from constitutional debility, struggle with vigorous efforts to resist the inroads of it. The success with which the contest is maintained is portrayed in the comparatively healthy expression of the body, and in the average duration of the malady. With the exception of the lungs, the animal system possesses considerable vigour, and the important functions of life continue, during the incipient progress of the tuberculous degeneration, and other forms of pulmonary disease, to be performed with almost wonted activity. The striking external signs of constitutional phthisis, such as the leuco-phlegmatic, or scrofulous habit, the fair complexion, nar-

row chest, and white teeth, are not constant, but only occasional symptoms. The ample chest and well-knit muscular powers are no protection against the agency of the external cause. Such conditions may retard for a time the ravages of the morbid action, but this ultimately prevails.

From these considerations, it is evident that important differences exist in the character of the disease, in the two cases specified. In studying the manifestations of it in the grinder, we have often been most agreeably surprised at the amount of temporary improvement, arising, perhaps, less from the treatment pursued, than from the individual having been withdrawn from the baneful influence of his occupation; the urgent symptoms having been kept at bay for a considerable time.

The gradual attenuation of the body in ordinary tuberculous phthisis is a prevailing symptom. We do not contend that the frame retains its strength and muscular development, when the disease is excited by obvious external causes; it decays, however, much more slowly, and, for a time, is scarcely perceptibly affected. In the advanced stages of the malady, every aggravation of it is an approximation to the concomitant symptoms of constitutional phthisis. We perceive, then, the exhaustion of the vital powers, the waste of the flesh, and the copious expectoration of purulent-like matter.

The differences in the progress of the disease will be more justly appreciated, when we point out the particular symptoms which characterise the pulmonary affection common to this class of artisans. The broad distinctions may be stated in few words.

1. The disease occurs, not generally from any constitutional predisposition, but from the irritation of a mechanical cause. Where the predisposition exists, as indicated by a scrofulous habit, narrow chest and weak muscular powers, the artisan is peculiarly liable to the malady, and falls an early victim to it. On the contrary, when the individual possesses a vigorous and well-developed frame, the system exerts itself to ward off the morbid action, and for a time succeeds, or limits, in an important degree, the influence of it. In such a case there is difficulty of breathing, though not distressing in its character, accompanied with manifest irritation of the larynx, trachea, or bronchial tubes, with

frequent cough and expectoration of mucus, mixed with the inhaled dust.

2. The duration of the disease is generally protracted. The average duration of constitutional phthisis is stated by writers to be about nine months; in the grinder, the average will be years, counting from the accession of difficulty of breathing, bronchial irritation, cough and expectoration. No doubt these frequently exist, when there is no evidence of tuberculous degeneration of the lungs. The grinder seldom, if ever, applies for medical aid in the incipient stages of the malady. The symptoms are not sufficiently severe to interfere with his daily occupations, and so reckless is he of the consequences which inevitably flow from them, that they scarcely rouse him to reflection. As we have been engaged for years in investigating the condition of this class of artisans, our occasions for studying the disease, in all its stages, have necessarily been numerous. Ordinary professional opportunities would not have furnished all the required information bearing on the subject; and the least interesting is certainly not that which is derived from the early symptoms of the malady, and its various modifications.

3. The artisan, except where a consumptive diathesis exists, is, with the exception of the pulmonary affection, in health. The appetite is generally good, the digestive powers vigorous, and the complicated process of assimilation seldom exhibits much derangement. During the continuance of the incipient symptoms, the fleshy appearance of the body is little diminished; the individual stoops forward, which arises in part from the bent position in which he works, as well as from the habitual cough with which he is troubled: in our opinion, largely from the latter cause. The expression of the countenance is often indicative of suffering.

4. In the advanced stage of the disease, there is less attenuation than in ordinary phthisis,—the breathing habitually *more* difficult, and the expectoration perhaps more copious.¹ The pupil of the eye is seldom much dilated, nor are the teeth white. The pulse is frequently as low as eighty or eighty-five pulsations in the minute. The countenance, in this stage, exhibits great anxiety.

¹ In one case there was a pound of purulent-like matter expectorated for some time, daily.

CHAPTER IV.

SYMPTOMS OF THE DISEASE.

The first traces of morbid action which fall under observation, are irritation in the larynx, trachea, or the bronchial tubes, accompanied with slight and occasional cough. These are frequently observed in the apprentices. They excite no attention, as they do not in any degree interfere with the ability of the individual to pursue his occupation. Medical advice is rarely sought in this stage of disease. We have at this moment a youth of seventeen years of age under our care, presenting these incipient symptoms; but the visit is made at our request, and not from any anxiety on his part. When the young are delicate, have entered upon the business at a tender age, are severely worked, and insufficiently nourished,—all which circumstances are frequently conjoined,—it is scarcely necessary to remark, that the constitution is unable to withstand the baneful influence of the circumstances in which it is placed. The body is stunted in growth, attenuated in form, and becomes early a prey to disease. The greater part of those who die under twenty-five years of age, from the effects of the trade, are of this description. In these the several stages of the malady are exceedingly short: the cough and difficulty of breathing pass rapidly into the severer forms of the affection,—degeneration of the lungs, as indicated by the expectoration, urgent dyspnœa, emaciation and exhaustion of the vital powers.

When the animal system possesses, however, an average amount of vigour, the incipient symptoms continue without any very manifest aggravation for years; nor do they, if they show themselves early in life, affect the general health. If they are first observed between twenty-five and thirty years of age, the constitution is too debilitated to arrest the progress of the symptoms, consequently these rapidly give rise to others more urgent

in character, and thus one series of morbid action is quickly succeeded by another, until at length the system breaks up, presenting unequivocal evidence of pulmonary phthisis.

The seat of the incipient symptoms varies in different individuals. In some, the mischief is seated principally in the larynx, causing frequent cough, and an obvious change in the tone of the voice, unaccompanied by any marked shortness of breathing. In others, this symptom is the most prominent, and the character of the cough shows the irritation to be in the bronchial tubes. The pulse is scarcely at all quickened: in the majority of cases not at all. There is no fever, and the tongue rarely presents any unnatural appearance.

In the next stage, the cough is much more urgent, and the difficulty of breathing is greatly increased. Both symptoms are aggravated on slight exertion. The countenance is expressive of suffering and anxiety, and the breathing capacity of the lungs is very much diminished, as indicated by frequent inspirations, as well as by direct experiments. The body is bent forwards, and gradually sinks into less space, but by imperceptible gradations. The process of emaciation is remarkably slow in numerous instances. Symptoms that, from their severity, scarcely appear compatible with the continuance of life, nevertheless co-exist with considerable fleshiness. The appetite is generally good, and the whole of the digestive apparatus performs its complicated functions, so as not, by any irregularity, to attract the attention of the sufferer. There is, perhaps, no condition more generally prevailing in that stage of the disease than the vigorous action of the digestive powers. It must not be understood, however, that the individual is not frequently labouring under symptoms of dyspepsia, such as distension and uneasiness of the stomach, sickness, eructations, and constipation; but the anxiety with which these would be regarded by the otherwise healthy patient, is seldom experienced by the grinder. His attention is absorbed by sufferings far more aggravated in character.

In this stage of the disease, the pulse is slightly quickened. It generally ranges between seventy-five and eighty-five pulsations in the minute. There is no hectic fever, nor increased heat of skin. The expectoration is mostly mucous, but in some cases is thick and opaque, and somewhat purulent in appearance.

It is during the co-existence of these symptoms that the individual is frequently subject to pains in the chest, which are aggravated on exertion, or on taking a deep inspiration. The artisan continues his occupation when, indeed, it is with difficulty that he can breathe at all, in the thick and smoky atmosphere of a town, during the winter months.

The chest generally sounds well on percussion; far better than would be anticipated from the pulmonary affection. This condition has often very much surprised us, being so opposed to what we commonly observe in ordinary phthisis, when the cough, dyspnœa, and other symptoms, are much less distressing than at this time in the grinder. On applying the stethoscope, the respiratory murmur is heard in its normal state over few points of the chest. Even where it departs the least from this condition of health, it is puerile. It is generally, however, bronchial in its character, conveying the impression that the respiration is principally carried on through enlarged bronchial ramifications; the truth of which we have established by dissections. It is often during the persistence of these symptoms,—chronic cough and laborious respiration,—that hæmoptysis, or a spitting of blood, occurs, which is not an unusual circumstance. We have at this moment a grinder under our care, in the last stage of the disease, who suffered from the symptoms described, in their various degrees, for seven years, until at length he was incapable of lying down in bed for several weeks, when he was seized with hæmoptysis, and in a few minutes lost several pints of blood. His breathing was instantaneously relieved, and continued for six years easier than in the seven preceding. Pectoriloquy is heard distinctly on the right side of the chest, immediately beneath the clavicle.

In the third and last stage, the wretched artisan is an object painful to contemplate. One well-marked and prevailing symptom is, the bent position of the body, and the exceedingly round shoulders. The respiration is extremely short and laborious on slight exertion. The expectoration is often very copious. There is unquestionably greater difficulty of breathing than in ordinary phthisis,—a more constantly hacking cough, less emaciation, less tendency to hectic, as well as an aphthous condition of the mouth: diarrhœa is also a less frequent attendant. There is no one

symptom that has arrested our attention more particularly than the state of the mucous membrane of the mouth. In constitutional tuberculous phthisis, how frequently we observe, even when the patient is little inconvenienced with cough and difficulty of breathing, a smooth and polished aspect of the tongue; and in the farther progress of the malady, a distressing aphthous condition of the mouth. In the phthisis of grinders, these changes are much less frequently perceived; and, when present, are less in degree.

It is scarcely necessary to remark that these distinctions are not established by all cases which fall under observation. In some there is a consumptive diathesis; or the constitution, from peculiar circumstances, such as extreme hard labour, insufficient food and clothing, or intemperate habits, becomes predisposed to the disease; and the symptoms evolved, in the progress of it, approximate to what we observe in ordinary phthisis. The distinctions are founded, however, on numerous and repeated observations, and their general accuracy will not be questioned. The pulse is small and soft, and is often as low as eighty and eighty-five pulsations in the minute. The emaciation, difficulty of breathing, and cough, gradually increase, and the patient at length dies from long-continued suffering and exhaustion.

The cases in the last or advanced stage of the disease, have appeared to admit of an important classification. In some, we have many of the leading symptoms of ordinary tuberculous consumption; in others, extensive pulmonary degeneration, associated with striking modifications of these symptoms. In the one class, which will contain a majority of the sufferers, a distressing or urgent *cough* has generally existed for years; in the other, the cough has been of much shorter duration, and slighter in degree, and has seldom excited the attention of the artizan until the breathing became short and difficult. In the one class, the cough long precedes the disordered respiration; in the other, it cannot justly be said to follow it; both are almost co-existent from the first. We will briefly sketch the difference in the symptoms observed in the two classes, in the advanced stage of the disease. In the one, in which the cough is the early and predominant symptom, there is less attenuation of the body, a less tendency either to diarrhoea or to hectic, and the breathing is much more

oppressed than in the other, and the expectoration is often exceedingly copious. The chest exhibits also considerable anterior rotundity, and even when there is unequivocal evidence of a structural change in the pulmonary tissue, the sound emitted on percussion is particularly sonorous. There is much greater suffering, and greater anxiety depicted in the countenance, in conjunction with these symptoms, than in those incorporated in the other class. And further, the tongue and the mucous membrane show, in most instances, a very slight departure from the condition of health. Diarrhœa is seldom present, except when chronic inflammatory mischief has long existed in some of the important abdominal viscera.

In the other class, in which the cough is scarcely recognised by the artizan, previously to the breathing becoming difficult, the body rapidly emaciates, the expectoration is less copious, the chest is somewhat contracted and flat, and on percussion, emits a duller sound, though often to a considerable extent sonorous, than when the cough has long preceded the dyspnœa. In both classes, tubercles are found in the lungs, though by no means invariably in cases in which the cough was the principal distressing symptom for years.

Hæmoptysis frequently occurs in both classes of cases. We are not, however, prepared to say in which it prevails to the greatest extent. The expectoration is often very peculiar, both in the second and last stages of the disease. It is by no means uncommon for the grinder, after a slight fit of coughing, to bring up black hard masses, in appearance accretions of dust, varying from the size of a pea to that of a small marble. In some cases, the individual is sensible of the presence of such, by an uneasy sensation which is experienced about the point where the trachea enters the chest. The sensation is described, as if occasioned by the motion of a foreign body, partly loose; and this sensation causes the grinder to hawk, until he succeeds in the ejection of it, which always relieves the breathing. We know grinders, at this moment, who expectorate such masses, and have done so for years, and having found, from experience, that long walks in the country facilitate the expulsion of them, take the exercise weekly for the purpose. When the expectoration, in the advanced stage

of the disease, is purulent, it frequently presents a variety of colours, as green, yellow, and black; the last has appeared to us to be much more common than in ordinary tuberculous phthisis.

The grinders are particularly subject to acute inflammatory affections; pneumonia, pleurisy, and rheumatism. The frequency of acute chest diseases arises from several causes. The position of the body when the grinder is at work is very unfavourable to the free action of the lungs. Perhaps in no occupation is the trunk so much bent forward, in a contracted form, and for the same length of time, as in the greater part of the grinding branches. The respiration is necessarily disturbed by this circumstance, and consequently the circulation of blood in the chest. This disturbance is unquestionably one important cause, creating a tendency to acute inflammatory action. The inhalation of the dust is manifestly another, from the irritation which it produces in the air-passages and the lungs, which, when combined with peculiar susceptibilities of the animal system, is calculated to excite acute diseases of the respiratory organs. He is also subject to be chilled, when heated from the warm room in which he works, or from certain parts of his labour. It must also be kept in mind, that he is often indifferently clothed and insufficiently fed; hence, ill adapted to withstand the severity of the seasons. In a subsequent part of this inquiry, we shall point out the nature and proportion of the inflammatory diseases to which he is particularly liable.

It appears, from our investigations, that the grinder is frequently troubled with gravel. Of the fact we have no doubt, though it is not in our power to assign a satisfactory reason. Several causes might be mentioned tending to create a predisposition to it, and among the efficient, the constrained and unhealthy position of the body is worthy of consideration. The respiration, circulation, and consequently the properties of the blood, out of which secretions, as well as excretions, are evolved, are disordered, and it is not strange that such affection should more frequently co-exist with this general derangement than with the ordinary conditions of health. How far the inhalation of dust may contribute to this result, we are not prepared to say.

Among the various symptoms which have fallen under our

observation, in the study of the pulmonary diseases of grinders, none have so rivetted our attention as the clear and loud sound which is emitted on percussion of the chest, in numerous cases of advanced structural changes of the lungs. We have no hesitation in stating, that the sound is frequently much louder than in health. In all the individuals in whom we have found this particularly marked, shortness of breathing and a distressing cough have always been present. The cough has generally existed for years. On this subject we speak from extensive investigations. On applying the ear or stethoscope to the chest, the respiration is exceedingly loud and bronchial in its character. The ordinary sounds of inspiration and expiration are sometimes not heard, or very indistinctly, and this peculiarity of the respiration is often detected, in various degrees, throughout both lungs, and when once heard, the peculiarity of it cannot be mistaken. Accompanying this symptom, is the prominence of the chest; a condition which is very obvious, when compared with the development of the thorax, in cases where the pulmonary degeneration is not associated with this kind of respiration.

Among the grinders suffering from the occupation, the aged—that is, persons from forty to forty-five years old—generally present this symptom, if they have long been subject to a violent cough. We have, at this moment, a penknife-grinder under our care, in whom the bronchial character of breathing exists in both lungs; he is, however, the oldest man in his branch, save two who have spent several years in the army. He is fifty-five, and has had cough and hurried respiration for nearly fifteen years. His constitution has been remarkably robust.

The bronchial respiration depends unquestionably on enlarged bronchial tubes;—dissection establishes the fact; and with the gradual enlargement of them, the pulmonary tissue, partly from the deposition of tubercles, effusion of frothy and often dark-coloured matter, or from having less freedom of expansion, becomes, to a great extent, impervious to air.

In some instances, the loud sound on percussion is not accompanied with the bronchial breathing, but with a murmur, as if caused by respiration performed at a distance from the surface of the lungs. We have imagined this to depend on an emphysematous condition of these organs. The chest, on these occa-

sions, was prominent, but not to a greater extent than in cases of bronchial respiration of long continuance.

In studying the pathology of the disease, we shall point out certain morbid conditions which show a marked distinction between the symptoms of phthisis, common to the grinders, and what are usually observed in constitutional tuberculous consumption. Before proceeding, however, to this part of the inquiry, we shall advert to the remarks of an excellent practical writer¹ on chronic bronchitis, occurring from ordinary causes, and also from the inhalation of dust.

A large proportion of the cases which fall under our observation, exhibiting organic mischief, in its various stages, would be regarded as cases of chronic bronchitis. We at once admit that there is considerable disease in the air-passages; the symptoms, however, do not accord with the description given by this able writer; not that we in any degree question its accuracy. We adduce the fact, in corroboration of the views which are expressed in these pages, respecting the modifications in the character and progress of the disease, from the nature of the exciting cause and the constitutional energies existing. A marked difference in the causes will be accompanied with corresponding differences in the effects; the due appreciation of which demands extensive opportunities of research, and an accurate examination of the morbid phenomena evolved.

It is remarked by Dr Hastings, in treating of chronic bronchitis produced by the contamination of the air by gaseous substances, that "the patient is not unfrequently seized with hæmoptysis, which is occasionally very profuse, and is accompanied with a great increase of dyspnoea and severe cough. The pulse too becomes accelerated, and is generally hard and strong. The surface is hot, the tongue white, and there is considerable thirst: occasionally blueness of the lips and general lividity of the countenance also appear." He further remarks, "whether hæmoptysis come on or not, if the bronchia be still subjected to irritation, the cough increases, and is attended with a copious expectoration of thick mucus, which is mixed with pus-like matter, and sometimes streaked with blood. The patient loses his flesh; the

¹ Dr Hastings.

pulse becomes quicker; the tongue continues loaded, and there is considerable thirst.”¹ In the numerous cases which have fallen under our observation, many of the preceding symptoms have not usually presented themselves, in so marked a character, in an analogous stage of the disease. The condition of the tongue has often much surprised us. It frequently exhibits a very slight departure from health, being neither furred, white, dry, polished, nor contracted. The comparative slowness of the pulse is another circumstance which has also particularly arrested our attention. A much greater frequency of it would be expected from the difficulty of breathing, urgent cough, often copious expectoration, and other distressing symptoms, than is generally found to prevail. Those which he describes occur in the preparers of yellow leather; the symptoms which have fallen under our observation, are produced by the inhalation of dust in dry-grinding, and by a peculiarly unhealthy position; the body being bent nearly double during the long hours of labour; especially in the grinding of penknives, scissors, forks, razors, needles, and all small articles of cutlery. A difference in the circumstances of the two classes of artizans, as well as in their habits, if accurately analyzed, would, perhaps, explain satisfactorily, the modifications in some of the constitutional effects arising from the occupations.

The position in which the grinder works is an important circumstance, and is, perhaps, nearly as injurious as the atmosphere which he breathes. One half of the body is inclined almost at a right angle to the other, over the small revolving stone, and the position is very little relieved by any of the processes of his labour. Hence it is evident that the free play of the lungs is interrupted. To this circumstance is unquestionably to be ascribed, in part, the frequency of pulmonary inflammation in this class of artizans, the diseases of the kidneys, the structural changes of the heart and important vessels, to which they are liable. In the course of this inquiry, we shall present the statistics of each grinding branch, the average mortality, the proportion of the different diseases in each, the degree of education possessed, and the physical condition of the artizans and their families.

¹ A Treatise on the Inflammation of the Mucous Membrane of the Lungs; by Charles Hastings, M.D. P. 273.

CHAPTER V.

PATHOLOGY OF THE DISEASE.

The morbid changes induced by the inhalation of gritty and metallic particles are various, arising from differences in the circumstances of the artisan, as well as from peculiar constitutional susceptibilities. In some branches of grinding, the individual is constantly breathing an atmosphere surcharged with dust; hence this condition, conjoined with low wages, and habits correspondingly depraved, produce, in a very short period, extensive structural mischief in the whole respiratory system. The affection of the trachea and bronchial tubes, quickly becomes aggravated in character, and is associated with obvious pulmonary degeneration. In other branches, the circumstances are less injurious to the health of the artisan, and his habits are proportionately superior. It is a singular fact, but it is nevertheless indisputable, that the more destructive any of the various departments of grinding, *the lower the morals and the remuneration of the workmen.*

As previously remarked, grinders may be divided into two classes, the one using the wet, the other the dry-stone. The articles ground by the former are mostly of a large size, such as saws, scythes, files, and edge-tools¹ generally. The articles on which the latter are employed are small, such as razors, scissors, pen and pocket blades, forks, and needles. There is a remarkable difference not only in the longevity of the artisans in these two classes, but also in regard to their intelligence and respectability. The wet-grinders, as a body, are greatly superior to the dry in education and pecuniary circumstances. It would naturally be imagined, that the more destructive the pursuit, the higher would be the remuneration; but such is not the case. As a general rule, the remuneration decreases with the increase in the

¹ By the term "edge-tools," in Sheffield, is only understood those of a heavier character than knives, scissors, or razors, such as axes, chisels, &c. The former only are known as "cutlery."

destructive tendency of the branch. This arises from several circumstances, to which we shall briefly allude. The wet-grinders are much fewer in number than the dry. The several branches, included in both classes, are in union or combination, for the purpose of regulating wages and other matters. In a long continued period of depression, the *extensive* branches frequently break down, the unemployed members being too numerous to be supported by the funds in hand, and the contributions of the artisans who have only partial work. When this occurs, the individuals are no longer held together by any common bond. They bid against each other for employment; the consequence of which is, that their physical condition gradually deteriorates with the prolonged struggle to live. It is scarcely necessary to observe, that during this state of things, the moral tone of the grinder is greatly lowered. He becomes indifferent or reckless in his conduct, his family is ragged and inadequately fed, the education of the children is neglected, and they are frequently put to work at eight or nine years of age. When good trade returns, it is in these branches, from the prevailing ignorance and degradation of the artisans, that the greatest proportion of apprentices is taken, so that the rate of remuneration, in consequence of this circumstance, is liable to be kept low.

It is also peculiarly worthy of remark, that in most of the branches of dry-grinding, boys of eight or ten years of age can be made useful, whereas, in the branches of wet-grinding, they could not possibly be employed with any advantage. The later they are put to work, the more likely they are to possess some education.

The members, in the several branches of wet-grinding, being much fewer in number than in the dry, it is comparatively easy to enforce the principles of combination, so that in a time of depression, the unemployed, being maintained, are prevented from competing with the employed; and in a season of prosperity, sound caution is exercised with respect to the admission of apprentices. Hence the grinders, in such branches, receive much higher wages than in the others, and these better wages, as a natural consequence, are accompanied with a superior physical, moral, and intellectual condition. The differences, in these several respects, are extraordinary. Were the occupations of both

classes of grinders equally detrimental to health, the higher and the more regular remuneration, and the greater amount of information possessed by the one, would modify, in an important degree, the baneful influence of the pursuit. The awfully destructive nature of it will always be seriously aggravated, by the ignorance and recklessness with which it is associated. Dissipation and low habits, by disordering the functions of life, render the system acutely susceptible of the agency of external circumstances, such as the inhalation of dust, and the sudden variations of temperature to which grinders are particularly exposed. It is also quite evident, that the diseases induced by the occupation, will pass much more rapidly through their various stages, towards a fatal termination, when the action of the external agents is conjoined with intemperate and dissipated habits.

The differences which we have pointed out in the condition of the grinders, occasion important modifications in the nature of the structural changes induced. The more irregular and dissipated their habits, the lower the rate of wages, and the more pernicious the particular department of grinding, the more extensive are the morbid effects produced in the animal system. We often perceive, under such circumstances, not only disease of the respiratory organs, which is the natural result of the habitual inhalation of dust, but serious derangements of other viscera, such as the stomach, the liver, the bowels, or the bladder, which tend to aggravate the primary and gradually increasing disorganization of the lungs.

In a previous part of this inquiry, in describing the symptoms, we made a few general remarks on the seat and nature of the diseases, which it is now our business more particularly to examine. In a large class of cases, the larynx and the trachea are primarily, and for a considerable period, alone affected. The irritation which exists in these situations, excites frequent cough, for a time unaccompanied with any expectoration, except a little mucus, which is often black and gritty. The grinder complains of a dryness in the throat, and occasionally of a sensation of tightness, and the voice gradually becomes hoarse, but this varies in different parts of the day. These symptoms, in the earlier stages, are readily relieved by emetics and external applications, such as leeches and blisters, and especially by change of air or

cessation from labour. We have seldom found them associated with acute inflammation of the air-passages, requiring active treatment, or with any constitutional disturbance, causing the acceleration of the pulse, the increased heat of the skin, or the functional derangement of any of the important viscera.

In the examination of the larynx, during the continuance of those symptoms, the mucous membrane is often much more florid and vascular than is natural: and, occasionally, small ulcerated points are observed. These symptoms, however, excite little anxiety in the grinder; nor does he, until they become much more aggravated in character, apply for medical advice. The mucous membrane, at this time, is, unquestionably, the seat of an inflammatory action, but so mild in its nature, that it will continue for a considerable period without exhibiting any obvious progress; though the respiratory organs are still exposed to the influence of the external cause, by which it was produced. From the acute sensibility of the membrane, and the constant action of an atmosphere surcharged with dust, much more formidable immediate effects would be anticipated. This sensibility, however, is gradually destroyed, and it is in consequence of this circumstance, that the progress of the inflammation is slow, and accompanied with no acute symptoms demanding the employment of energetic measures.

It is a general law of the animal system, that the various functions of life adapt themselves to new conditions, by which disease is corrected, or the course or severity of it greatly modified. And this law is exemplified in the way in which the mucous membrane of the air-passages accommodates itself to the action of an external irritating cause, which would otherwise be fraught with the most serious and immediate results.

Almost in all cases, in which the foregoing symptoms have long existed, the mucous membrane becomes thickened, and is often excessively pale: both conditions are frequently observed in a very marked degree. The thickening is a natural consequence of the irritation to which the membrane is constantly exposed. The action of the capillaries is, of course, increased, and whether it is expended in promoting a copious secretion or not, the inevitable effect is the accretion of matter. And it is manifest, that this change is accompanied with the gradual diminution,

within certain limits, of the sensibility of the part, until, at length, extensive structural modifications result.

The irritation which is primarily induced, in the larynx and the trachea, may be regarded as invariably extending to the principal divisions of the bronchi, and ultimately to their numerous ramifications. The evidence of this is shown in the character of the cough, and the frequently uneasy sensation which is experienced at the upper part of the chest. Perhaps there is no symptom which so generally prevails, in this and every subsequent stage of the disease, as the distressing feeling in the vicinity of the bifurcation of the trachea. It is variously described by different individuals, and it unquestionably originates in very different conditions of the parts. By one, it is stated to be a sensation of constriction, as if the air-passages were diminished in calibre: by another, in addition to the constriction, as if gritty matter had accumulated and formed a loose body, not only conveying an impression to the sufferer that it might be brought up by the dry, hawking cough, to which it seems to give rise, but something being actually expectorated, from the size of a pea to nearly twice that of a bean; which always affords relief. That the body ejected is almost wholly formed of dust, does not admit of doubt. In some instances it is hard, black, and gritty. The fact has been called in question by some pathological authorities, because such accumulation has very rarely been found after death. This is, certainly, no valid objection. The expectoration of such bodies takes place only as long as the artisan continues his occupation; that is, as long as he breathes the atmosphere surcharged with dust. He does not die in the stage of disease in which this phenomenon occurs. He undergoes, perhaps, several years of suffering previously to a fatal termination. In the subsequent, or more advanced stages of the disease, he becomes incapacitated from labour, hence he is no longer inhaling dust; and further, the very copious expectoration which accompanies the aggravated symptoms, and which is derived from the morbid surface of the air-tubes, will necessarily remove any dust that may have accumulated for months before.

We stated, in a previous part of this inquiry, that, in the advanced stages, the expectoration has appeared to us more frequently of a peculiarly dark colour than is usually observed in

phthisis occurring under ordinary circumstances. This appearance we ascribe to the dust which has been inhaled, not being confined to the larger branches of the bronchi, but taken into the very substance of the lungs, and which becomes mixed with the secretion, whether purulent or otherwise, from the breaking up of the pulmonary tissue in the progress of the disease.

The grinder is subject to the influence of two very different kinds of dust. The one is composed of the particles of stone and metal, evolved in grinding; the other is produced by what is called polishing, which is giving, what the term implies, a brilliancy to the article, and this is done upon a small revolving machine,¹ the circumference of which is covered with leather, and charged with crocus or emery. We have often been told by the artisan that this powder, which is exceedingly fine, is much more distressing to the respiration than the dust which ascends from the stone. We shall again recur to the consideration of the transmission of either into the substance of the lungs.

The same changes take place in the mucous membrane of the bronchi and their ramifications, that we have described as occurring in the larynx and trachea, in general, to a greater extent. The membrane is often much more thickened, but usually of the same pale aspect. When the irritation is unequivocally set up in the bronchi, and the smaller air-passages, the cough becomes troublesome, the expectoration more copious, and in this stage there is a tendency to emaciation. We use the word *tendency* because, in numerous cases, where the constitution is originally robust, it is remarkable how little change is externally perceptible, in connection with symptoms that are indeed formidable in their nature. When the constitution is deficient in tone and vigour, and the artisan is overworked and inadequately nourished, the same train of symptoms is associated with very different conditions. The loss of flesh is very evident, and there is considerable anxiety in the expression of the countenance. The conditions vary according to the character of the constitution, and the circumstances of the individual.

In treating generally of the symptoms produced by the inhala-

¹ This implement is in the form of the trundle of a wheelbarrow, but narrower on the edge, and solid from the axle, where it is of a greater thickness; it is technically denominated a *Glazer*.

tion of dust, we endeavoured to show that they were dissimilar in two classes of cases; and the structural changes in each are very different. In the one, in which the cough and bronchial irritation have, perhaps, existed for years, the mucous membrane is more thickened than when the cough has followed rather than preceded disease of the lungs. The next striking difference, however, is, that in the former case there is an obvious enlargement of the bronchial tubes, and of portions of their numerous ramifications. We have sometimes found the latter several times larger than is natural, and such modifications have been detected occasionally throughout a great part of each of the lungs. For the present, we shall confine our remarks to this class of cases.

Our attention was directed to a minute examination of the lungs, in reference to this structural change, from being, at the commencement of our inquiries, very much perplexed by the striking differences in the symptoms of the grinders, making the same general complaints, shortness, and difficulty of breathing, cough, and copious expectoration. The difference in the results of the treatment tended still further to perplex us. In some, rest, the application of a few leeches, and afterwards a blister, conjoined with expectorant remedies, produced a marked improvement, when the prognosis we had formed was exceedingly adverse. In others, in whom the symptoms were less distressing, and the opinion expressed much more favourable, we were often disappointed in the employment of remedial measures. The success was far from being proportionate to our anticipations. It is scarcely necessary to say, that we were led to an elaborate investigation of the cases. We took down, at length, the history of each, noting particularly the duration of the cough, whether it had preceded or succeeded difficulty of breathing; the connexion, as to time, between the cough and the existing debility; the tendency to clammy and profuse perspirations; the character of the digestive functions; the development of the chest; the phenomena discovered on percussion, and by auscultation; the condition of the pulse; the temperament of the constitution; and, lastly, the habits of the individual. After we had pursued this plan for a considerable time, we began to perceive that the cases might, with great propriety, be formed into two classes. In the one, we placed the prominent and clear-sounding chest on per-

cussion, in which the cough was often extremely troublesome and the expectoration copious, the breathing very hurried, almost without exertion; and yet the appetite was good, and the digestive functions regular; nor was the body much emaciated. In the other, the contracted or flat chest, and which on percussion emitted a somewhat dull sound, though not invariably, in which the expectoration was also often copious, but less frequently accompanied with severe fits of coughing, and the cough had perhaps existed only from six to eighteen months; when in combination with the other train of symptoms, it had probably been present as many years: emaciation, occasional profuse perspirations, increasing debility, and the slightly accelerated and soft pulse, were likewise generally observed.

The symptoms, in the first class, originate in irritation of the trachea and bronchial tubes; and we have no doubt, that the cough, which exists for years, produces such an important change in the capacity of the air-tubes, and in the numerous cells in which they terminate, that a condensation or clogged condition of the pulmonary tissue is prevented, or at least, modified in an important degree. The fact is unquestionable, and the effect must necessarily follow the constant operation of such a cause. We again repeat, that the effect is inevitable, either in reference to the air-tubes or the cells of the lungs. The violent and full expirations occasioned by coughing are, of course, immediately followed by inspirations correspondingly ample, by which the air is introduced in large quantities into the lungs. The elevation and depression of the chest are only just perceptible in ordinary respiration. When ten times the amount of air, not only in individual acts, but in a given time, enters the lungs, these organs are expanded in a correspondingly increased proportion. The air-tubes and the cells are under the necessity of doing ten times the amount of functional duty; and it is a law of the animal system, that the development or enlargement of an organic apparatus is according to the exercise of it. We know of no exceptions, nor can we imagine one.

If the attention of pathologists had been particularly directed to this important branch of research, we have no doubt that such changes, which have occasionally been detected, would have been found frequent occurrences. Our own position has, indeed, been

peculiarly favourable for the investigation. We have had, almost daily, under our observation individuals possessing from nature sound constitutions, a large and well-developed chest, with no tendency to pulmonary degeneration, yet from the occupation which they pursue, labouring under the most aggravated forms of it. It is in cases of this kind, that we have the best opportunity of tracing the effects of particular causes. The respiratory organs do not at once, or readily, yield to the baneful influence of the external circumstances; the vital energies with which they are endowed are vigorously roused to counteract this influence, and though unsuccessfully brought into play, the struggles which result tend materially to lessen the severity of it, and to postpone, for years, the fatal termination to which it leads.

To assert that individuals, in whom these structural changes have taken place to a considerable extent, such as the dilatation of the bronchial tubes, the expansion of the air cells, the thickening and inflammatory condition of the mucous membrane, might, if withdrawn from the occupation, or protected against the agency of the dust, live many years in the enjoyment of comparative health, is not an opinion destitute of proof. We have evidence in confirmation of the fact. Some artisans, acting on our advice, have left the trade to pursue another less baneful in its tendency, and others have, by a contrivance to which we shall subsequently allude, removed the dust as it was created; and in these instances it has been gratifying to observe the immense subsequent improvement in the condition of the lungs. The cough and difficulty of breathing have remained, when in a severe form, analogous to the symptoms of humoral asthma; but the general appearance of the body has been indicative of robust health. The chest, in these individuals, has always been particularly prominent, and has retained the clear sound emitted on percussion.

We have also remarked, in corroboration of this train of reasoning, that when the grinders have been withdrawn from the occupation, perhaps ten or more years in the army, and have returned to it, they frequently present afterwards the symptoms just described. They are indeed the *aged* of the branch to which they belong. Some of them live to the extraordinary ages of 60 and 65. It is only, generally speaking, in persons of

sound and vigorous constitution, that we perceive well-marked illustrations of these structural changes in the respiratory organs, accompanied by symptoms which are sometimes only slightly modified in character, in the space of years. The grinders, who have been in the army, resume the occupation at the age of 35, or later, in sound health, with no incipient tendency to pulmonary disease; hence the lungs and the whole system are in a condition, if not effectually to resist the agency of the dust, to ward off the severity of its effects for years.

It must not be understood, from these observations, that the structural changes of which we have spoken, are a protection against the occurrence of pulmonary degeneration. They must be regarded only as retarding, but often in a remarkable manner, the progress of it. They do not prevent the subsequent production of tubercles, nor the various modifications which they undergo, from the small miliary body to the breaking up of an immense mass, or the formation of a correspondingly ample cavity. Tubercles, however, are not invariably found in the lungs, and to what extent this may be owing to the structural modifications in the air-passages and the pulmonary tissue, we do not presume to state. Perhaps further researches will remove the obscurity in which this part of the subject is involved.

The necessitous circumstances of the grinder compel him to continue his pursuit as long as he can possibly work, so that, in every aggravated stage of suffering, he is exposed to the influence of the agent by which the disease was produced. That he at last breaks down, cannot be a matter of surprise to those in any degree acquainted with his condition.

In the other class of cases, in which the disease may be regarded, with some reservation, as commencing in the lungs, it much sooner runs its course. The chest gradually becomes contracted and flat, the body rapidly loses flesh, and the artisan, from debility, is disabled from following his business, for many months previously to his death. When the disease, as a distinction, originates in the air-passages, the grinder, in general, has a less protracted period of suffering after his entire cessation from labour. His bodily energies allow him to pursue the occupation, until the degeneration of the lungs has made such progress, that the functions of life can be carried on only for a short time.

There are many cases in which the morbid action, almost from the first, seems to exist both in the substance of the lungs and in the bronchial tubes, and then of course all the phenomena of the disease are proportionately modified in character. Such differences will readily be imagined, when it is taken into consideration that the individuals vary in constitutional susceptibilities, in conduct, in the scale of remuneration, and in the degree of the baneful influence to which they are exposed. An attempt at classification, to be practically useful, must seize only the more prominent and prevailing phenomena. To descend to minute particulars, would be to multiply refined distinctions without any obvious advantage.

The differences in the morbid appearance discovered after death, in the phthisis of grinders, and that occurring under ordinary circumstances, have appeared to us to be the following:—

1. Adhesions between the lungs and the pleura costalis are generally observed, and are mostly extensive and firm; which would be anticipated from the great liability of the grinder to inflammatory attacks of the chest, which are often allowed to pursue their course, unchecked by rest, attention to diet, and active remedial measures. The attacks are generally subacute, and though attended with pain and inconvenience, the grinder regards them with comparative indifference. The extent to which this feeling is carried, it is scarcely possible to describe. It arises in part from his lamentable ignorance,¹ and also from the impression, that such evils are the inevitable accompaniments of his occupation; and we would further say, that the complicated character of his sufferings,—severe labour, often miserably low wages, bodily ailments, and insufficiency of food, cause him to look upon life as a questionable good. He forms a mean estimate of the value of it.

2. The next appearance, which is frequently observed, is the great enlargement of the bronchial glands, immediately at the bifurcation of the trachea, or, more correctly speaking, the conversion of them into a black, hard, gritty substance, varying in size from half a marble to a large hazel nut. We have seen

¹ If such men were sufficiently educated to be able to peruse and understand the principles of that admirable work, which speaks to every individual, *The Constitution of Man*, by Combe, they would, indeed, be taught to reflect.

them of the latter size. In cutting them, the sound is precisely the same as if the scalpel were directed against a somewhat soft stone; and when portions are cut away, the surface is black and polished, and in passing the edge of the scalpel over it, grates as if entirely composed of such material. Such masses are commonly detected in grinders who have belonged to the most destructive branches. We are not enabled to state the composition of them.

3. In several cases we have also found similar substances, and to appearance, analogous in composition, varying from the size of a currant to that of a bean, in almost every part of the lungs. We have detected them in portions of these organs which exhibited every degree of disorganization, from the first questionable change of structure, to the formation of softened tuberculous masses. In some instances, the lungs have presented an appearance as if black currants had been distributed throughout the whole substance of them, and were not accompanied with similar bodies of a larger size, but like these were hard and gritty. They were perceived on the surface of the lungs as well as in the internal structure.

4. The frequent occurrence of another condition is also worthy of notice, arising most probably from the peculiar occupation of the grinder; we certainly have not found it in any thing like the same proportion of instances in ordinary tubercular phthisis; viz. the engorgement of the lungs with a black or dark fluid. This is sometimes only in certain portions of them; but in a case which recently fell under our observation, it existed throughout both lungs, in which there were no tubercles, nor any well-marked structural changes. The pulmonary tissue was firmer than natural, but crepitated slightly, nearly throughout, and this condition was the cause of death. The individual had had, for several months, a troublesome cough and difficulty of breathing, was little emaciated, and had always lived well. He was a stove-grate grinder, in certain parts of which business, especially in what is called glazing, which is smoothing the surface of the article, clouds of fine dust float in the atmosphere breathed by the grinder.

In treating of the pathology of the disease, we have in the preceding remarks, confined ourselves to pointing out what

may, perhaps, be regarded as its peculiar characteristics. At the same time, it must be kept in mind, that some of these distinctive conditions belong, not to the grinders generally, but particularly to certain branches, in which the circumstances are the most aggravated. The justness of these observations will be appreciated in our subsequent labours.

In examining the cases related by Dr Hastings, in which disease was produced by the inhalation of dust, we do not find, in the *post-mortem* appearances, some of the results to which we direct particular attention; such as numerous bodies of hard gritty substances, pervading the pulmonary tissue, or the enlargement and conversion of the bronchial glands into the same kind of matter; nor does he allude to the dilatation of the bronchial tubes and their ramifications, nor to the presence of a dark coloured fluid in portions or in the whole of the lungs. In his cases, the mucous membrane of the trachea and bronchia was generally found to be highly inflamed and extensively ulcerated; hence, as we have previously remarked, the symptoms of the disease and the pathological conditions will differ according to the nature and quantity of the dust inhaled, the position of the body during work, the habits and other circumstances of the artisan. A little consideration will show the importance of attending to such distinctions, which by some writers have been lost sight of, in treating of the effects produced by the inhalation of dust. To do justice to the subject, it is necessary to study the particular branches of the same general occupation. It is in the highest degree unphilosophical to infer results concerning the influence of any trade, from what is known respecting the influence of another, though there may be several analogous circumstances associating both.

We shall conclude this part of the inquiry by giving the outlines of a case which does not often fall under observation, and which is far from being devoid of instruction. A fork-grinder of good constitution and of regular habits, suffered, when he was 31 years of age, from a dry hawking cough, unaccompanied with much pain, but which, after a time, was followed by spitting of blood and copious expectoration of a black or dark coloured matter. He was reduced to the last degree of emaciation. His family, believing the disease to have been induced by his trade, sold

while he was in this state, his working tools, determined, should he recover, that he should pursue it no longer. He did recover, and for thirteen years was engaged in another occupation. During the past year, from the depression of the times, he was thrown out of employment, and was under the necessity of applying to the parish. The unfortunate change in his circumstances, exposure to cold, and insufficiency of food, brought on, with the exception of the spitting of blood, his former train of symptoms; and, after a few months' suffering, he died, excessively emaciated. The *post-mortem* examination revealed the secret of his recovery thirteen years ago. On opening the chest, extensive adhesions were found between the upper half of the right lung and the pleura costalis. The lungs did not collapse on opening the chest, and presented a peculiar appearance. Externally, as well as throughout the whole substance of them, numerous small black gritty bodies were observed, about the size of currants; as well as others, three, four, and five times as large, formed of the same material, and which strongly resisted the edge of the scalpel. In the right lung an immense cavity was discovered, occupying nearly one-third of it. An idea of its capacity may be formed from the fact, that the gentleman, whose case it was,¹ after laying it partly open, introduced his fist into it, and even then there was room for an additional body almost one-third the size, before the parietes of the cavity would be on a level with the rest of the lung. The sac was formed of a firm strong semi-cartilaginous membrane, into which no bronchial tubes opened. It contained a small portion of the *débris* of the lung. The ramifications of the bronchi were considerably dilated, the mucous membrane of the air-passages much thickened, but presented no appearance of ulceration or the traces of it. The bronchial glands, at the bifurcation of the trachea, were converted into a hard black gritty substance, about four times the size of a bean. Besides the black bodies found in the lungs there was no evidence of tubercles. With the exception of a portion of the upper part of the left lung, which was firmer than the liver, the lungs were slightly crepitous, though engorged; and

¹ Mr Porter, surgeon to the Sheffield Dispensary, and at which examination, Mr Henry Jackson, surgeon to the Sheffield General Infirmary, was also present.

on slicing them, a frothy fluid freely exuded. There was no appearance of pus.

The point of particular interest in this case, and which indeed is instructive, is the large cavity, which was unquestionably the cause of the unexpected recovery of the individual thirteen years before. It seems also equally clear that the numerous black gritty substances, which pervaded the whole pulmonary tissue, were formed when he pursued his original occupation,—the most destructive of all branches, fork-grinding. The breaking down of these bodies, with the extensive mass of the right lung, would account for the peculiarly black appearance of the expectoration in his first attack of disease. It was at this time that he suffered from spitting of blood, which, in conjunction with other symptoms, may reasonably be referred to the rapid degeneration of the upper third of the right lung, which was ultimately expelled in its last morbid changes. We also perceive, in this case, the general dilatation of the air-tubes, which most probably took place to some efficient degree when the patient was suffering from the pulmonary affection, and contributed, perhaps, towards recovery, by maintaining the lungs in a condition favourable to the permeation of the air.

CHAPTER VI.

CONSIDERATION OF THE REMEDIES TO BE EMPLOYED IN THE TREATMENT OF THE DISEASE.

In the previous investigations, we have explained the manner in which the disease of the respiratory organs of grinders is produced, its nature, and the modifications which it presents; it now becomes our duty to point out the remedial measures which the symptoms have suggested, and which experience has found to be of service. It will readily be imagined, that in the aggravated stages of the disease, and in constitutions naturally delicate, or undermined by dissipated habits, art will be of little avail in arresting the progress of decay, or in affording any substantial re-

lief. As already remarked, so thoroughly reckless is this class of artisans, largely from ignorance, but also from an indifference about life, that it frequently happens, that the first application is made to the medical practitioner, when extensive structural changes have taken place, which, at most, admit only of slight amelioration. Had we not been observers of the fact, we could not have believed that men living in what is designated an enlightened age, and in a civilized country, could have dragged on a miserable existence for years, without feeling, or exciting much solicitude about the results.

In treating of the pathology of the disease, it was shown, (and the distinction is of great practical importance,) that the symptoms, though presenting certain analogies, such as cough, expectoration, and difficulty of breathing, were nevertheless associated with very different structural modifications, and admitted of an easy classification. In the one case, they were often accompanied with considerable constitutional vigour, and though harassing in the extreme, interfered comparatively little with the appetite or the digestive functions; and in connection with these symptoms, the chest was observed to be prominent and well developed. In the other case, the thorax was remarked to be flat and contracted, the powers of life feeble, and the animal frame exhibiting indications of gradual emaciation. We shall first consider the treatment in reference to the symptoms included in the former class, which, from various circumstances, are the most pregnant with interest. It is in relation to these symptoms, that remedial measures are frequently found exceedingly efficacious.

When a grinder comes under our care, complaining of a distressing cough, difficulty of breathing, expectoration, sometimes copious, but occasionally slight; and we find on examination that the chest generally sounds well, and that the respiration, though bronchial, is distinctly heard in both lungs; other symptoms, though not invariably, accompany these conditions. The pulse is usually under 85, and moderately strong; the appearance of the tongue is nearly natural; the appetite is scarcely at all impaired, and the digestive organs are acting with considerable energy. The patient also often complains of occasional and severe pains in the chest, which are most commonly aggravated on a deep inspiration. The association of these symptoms can be common occur-

rences only where the healthy and robust constitution is exposed to the inhalation of gritty particles. A much less amount of pulmonary disease, under ordinary circumstances, would exhibit a very different train of phenomena.

In the treatment of the urgent symptoms, such as cough and difficulty of breathing, we have observed the greatest benefit from the application of leeches, occasionally followed by blisters. In the employment of the former, we seldom prescribe more than four or six, often less, and repeat them according to the circumstances of the case. We have found much greater advantage from the repeated application of a small number, than from any other mode of treatment. We ascribe this to the fact, that acute inflammatory action generally exists in some part of the chest, and though not the cause of the prevailing symptoms, tends materially to aggravate them. In a previous part of this inquiry, we have remarked, that in the *post-mortem* examination of this class of artisans, adhesions, sometimes exceedingly extensive, are almost always found between the pleura pulmonalis and costalis. We do not remember one exception, in the cases which have fallen under our observation. We are satisfied that the marked improvement which results from this treatment is very frequently to be traced to the diminution of this inflammatory action, which is very rarely accompanied by any constitutional febrile derangement. The system will not bear active depletory measures. The strength is considerably less than would be imagined from the condition of the pulse, and the appearance of the patient; we have often observed great exhaustion consequent on the application of a few leeches.

We are also in the habit of employing blisters, but seldom without the previous local abstraction of blood. Alone, they do not produce that amount of good which results from the combination. Our practice is to prescribe them small, perhaps two inches square, and to allow the irritated surface to heal, so that, if necessary, we have an opportunity of repeating, at short intervals, the external treatment, and prevent the suffering which is inseparable from the application of large blisters.

The internal remedies, on which we shall make a few remarks, are emotics, expectorants, alteratives, and tonics. When the expectoration is copious, and the cough distressing, the efficacy of

emetics is unquestionable in numerous cases. They relieve the cough and the difficulty of breathing, and the expectoration is very much diminished in amount. The form which we usually prescribe, is a scruple of ipecacuanha, and one grain of tartar emetic. We are cautious, however, in the employment of the latter, in consequence of the severe depression of the vital powers which it sometimes produces. The skin frequently becomes cold and clammy, and the pulse slow and feeble, from its influence. We do not regard the efficacy of emetics, in this and similar cases of pulmonary disease, to arise from any change resulting in the condition of the stomach. The great good is to be ascribed to the violent action of the respiratory organs, by which the circulation in the lungs is occasionally immensely facilitated. Congestion is relieved; hence the capacity for the reception of air is proportionately enlarged, and this change is necessarily associated with an improvement in the qualities of the blood, in which the whole animal system participates, but especially the respiratory organs. The morbid condition of the secreting vessels of the bronchi and the trachea is, to a certain extent, corrected by the modification induced in the distribution and the properties of the blood. That such are frequently the effects of emetics, judiciously employed, is evident from various symptoms, such as the freer breathing, the less anxious and clearer expression of the countenance, as well as the fuller pulse. We know of no single symptom that more accurately marks the alteration in the circulatory system, than the change in the expression of the countenance. The dirty or yellow tinge of the skin, and the dull heavy eye, often become clear and bright, within twenty-four hours after the action of an emetic. We speak from repeated observation of the fact.

The benefit which results depends on two circumstances,—the condition of the lungs, and the degree of respiratory action which is caused by the remedy. When congestion is to be inferred from the suddenness in the aggravation of the difficulty of breathing, the somewhat bluish and swollen aspect of the countenance, and the small and feeble pulse, it is then that the action of emetics is fraught with the greatest amount of good. In accordance with the view which is here given of the *modus operandi* of an important class of remedies, in the exhibition of them, the

object is not to produce nausea, but free, repeated, and an almost painful degree of vomiting, otherwise we shall be disappointed in the anticipated benefit. In the cases which are particularly specified, as calculated to be relieved by this plan of treatment, an emetic, in the interval of several days, is repeated, and often with great advantage. When the cough and difficulty of breathing, and the structural changes in the bronchial ramifications, have been of long duration, an emetic may possibly be of service, but we seldom observe much good result from it.

In the consideration of the treatment of the pulmonary affections occurring in grinders, it must be kept in mind, that in the majority of instances it is not possible to effect a cure. Disease has often made considerable progress before it falls under our observation; and, farther, the necessities of the artisan compel him to pursue the occupation which has occasioned his suffering, and often under circumstances of peculiar hardship. In a period of depression, he is inadequately fed, ill-clothed, subject to severe labour from the diminished rate of remuneration; or, from being a recipient of parish pay, he is exposed to the inclemencies of the season. And in a period of prosperity, we regret to confess that the ample means which he possesses are too generally associated with dissipated habits, and a recklessness of conduct, injurious in the extreme to health. When the patient can be induced to exchange his pursuit for some other, less detrimental, the steady employment of remedies frequently produces a much greater amount of improvement than could possibly have been anticipated.

Among the most useful remedies to which we have recourse in the treatment of the urgent symptoms under consideration, are expectorants; but alone, their value is often very limited. Employed in combination with leeches and blisters, they allay the irritating cough, and the distressed breathing; and secure tolerable nights. The most useful of this class, are the tincture of ipecacuanha, oxymel of squill, and the syrup of poppies; using as a medium, camphor mixture, mucilage, decoction of liquorice or liverwort. The most efficacious combination, in form of pill, is perhaps equal parts of the storax, the compound ipecacuanha and blue pill, two or three being taken at bed-time, or once twice or three times a-day. We modify this combination according to the urgency of the symptoms. If the cough be ex-

ceedingly distressing, we increase the proportions of the two former, and in place of the latter, add six grains of calomel, and occasionally a grain of tartar emetic to the whole. We are not, however, particularly partial to the latter, in consequence, as we have already remarked, of the depression which it sometimes produces. We have not observed any unpleasant effects from the employment of the various preparations of opium; on the contrary, in conjunction with the remedies specified, it is invaluable in allaying irritation, without impeding expectoration. We at one time tried, in numerous cases, hydrocyanic acid, but with no evident advantage; and occasionally, even in moderate doses, it gave rise to unpleasant symptoms.

The early treatment of the disease consists in the application of a few leeches or a blister, conjoined with expectorants, though not always with the latter. After having effected some little improvement in the cough and difficulty of breathing, we have recourse to tonics, and frequently with the most marked advantage. We were formerly afraid of employing these, except such as were exceedingly mild in their character, in consequence of the cough, the hurried breathing, and the copious expectoration; experience has since taught us, however, that some of the most powerful of the vegetable tonics may be prescribed with great benefit. A just view of the pathology of the disease, and a knowledge of the circumstances of this class of artisans, would certainly suggest the employment of them. When we consider that the disease is generally not one of inflammatory character, save the superficially seated inflammations to which we have alluded, but consists in structural modifications, such as the enlargement of the bronchial tubes and air-cells, a thickening, and often a softened condition, of the mucous membrane of the air-passages, from long continued irritation, a condensation of the pulmonary tissue, or a slowly progressive disorganization of the lungs, tonics will not appear inadmissible. Further, the patient perhaps has been a free liver and has stimulated largely, so that the system has become habituated to artificial sources of excitement, and which, to a modified extent, are then necessary for the enfeebled powers of life. If, in addition to these circumstances, and which indeed is frequently the case, the artisan has been long straitened in his means, and has not had the ability to pur-

chase even substantial articles of food, this will further explain the great good which occasionally follows the use of tonics. The first which we prescribe are, generally, the mild bitter infusions, in combination with expectorants. The most important of this class is the compound cascarilla mixture; and we regard it as particularly valuable, where there is a twofold object to accomplish, as in cases of this kind. The remedy to which we attach, however, the greatest importance, and which, in some cases, has produced extraordinary results, is cinchona, used both in infusion and in substance. To the infusion, we generally add the nitric or sulphuric acid; and when given in substance, it is mostly in combination with port wine. In numerous instances, where almost immediate death seemed inevitable, from the copious expectoration, hurried breathing, and rapidly increasing debility, we have observed a remarkable resuscitation of the powers of life, from the employment of it. The expectoration has diminished, and has changed from a thick purulent character to a thin frothy mucus; and the strength has been greatly improved, so much so, that the patient, who was regarded as thoroughly broken in constitution, has been able to resume his occupation, and continue it for several years.

The cases in which we have remarked this improvement have been such as presented the aggravated forms of the disease, and which had generally existed for years. We sometimes prescribe the remedy in conjunction with the occasional application of leeches, the latter being required to combat the severe local pains in the chest, the nature and origin of which we have previously explained. The bark is seldom prescribed, unless the expectoration is comparatively free and copious, and never when any existing local inflammation gives rise to the hot skin and the hard pulse. It is scarcely necessary to remark, that in the employment of these remedies, particular attention is always directed to the condition of the important secretions.

We have, in a previous part of this inquiry, stated that diarrhoea is a very unusual symptom, even in the severe stages of the pulmonary disorganization, when associated with the prominent and clear-sounding chest; nor is the alimentary canal the seat of frequent irritation or derangement. These are some of the differences which distinguish the disease from hereditary consump-

tion. In several cases, when the structural changes of the lungs had made considerable progress, a permanent withdrawal from the influence of the occupation has been followed, in a remarkable degree, with an improvement in the urgent symptoms. The cough and the short breathing, modified in degree, always continue, but the copious expectoration becomes greatly diminished and less purulent in character; the strength is increased, and the countenance loses somewhat of its anxious expression. For some years, the process of slow pulmonary disorganization is arrested. In some of these cases, it is not possible to detect the slightest respiratory murmur in one lung, and only partially in half of the other. In a close observation of these cases, we have remarked that the individual is subject to occasional relapses, in which the expectoration becomes copious and pus-like in character, and the animal system gradually emaciates. After a time, these symptoms are arrested, and he regains his previous state of health. Independently of these relapses, he is liable to severe local pains in the chest, and which require the application of leeches or blisters. All these attacks are evidence of the extensive disease existing in the lungs, the progress of which is, for a time, arrested, by the individual being placed under the influence of more favourable circumstances, and by the employment of prompt and efficient treatment.

In the consideration of the remedies applicable to the other class of symptoms,—the contracted and flat chest, the weak and declining powers of the animal system, and the small and soft pulse, it is not necessary to occupy much time. These cases do not differ, in any important degree, from many of the ordinary cases of consumption, and the analogy is carried out by the little success which attends the use of remedial measures. Experience has not suggested any treatment which has been fraught with any large amount of benefit, beyond what is familiar to every practitioner. The employment of tonics, and removal into the country, occasionally arrest, for a short time, the progress of disease; but we regret to confess, that such instances are the exceptions to the rule. The expectoration generally goes on increasing, the cough becomes daily more distressing, the depression and sinking of the vital powers more apparent; and it is needless to add, that one aggravated symptom quickly succeeds

another, and death at length closes the scene. In the treatment of such cases, we have seldom seen much good result either from the application of leeches or a blister, beyond a very temporary alleviation of the cough, or pain in the chest. Tonics, change of air, and generous living are indicated, and are the most efficient in practice.

Our attention was, several years ago, directed to the condition of the grinders, in the hope that something might be devised to mitigate the evils under which they labour, and the lengthened investigation into which we have entered, is the result of much thought and personal observation. Our object, at the commencement of the inquiry, was less to study the phenomena of disease, than to induce the legislature, by a statement of general facts, to take the appalling circumstances into consideration, with the view of enforcing measures to correct them. And we are not, at the present time, without well-grounded confidence that the legislature will at length interfere. When it is considered that, in this town, some thousands of individuals pursue the pernicious occupation of grinding, and that many thousands depend upon these for their daily bread, it becomes an imperative duty to endeavour to correct evils fraught with so much misery and wretchedness, not only to the artisans and their families, but injurious in the extreme to the town at large. This subject was warmly agitated, nearly twenty years ago, by enlightened individuals, and their exertions entitle them to our grateful remembrance.

The result of the efforts made at that time was the invention of a magnetic guard or mouth-piece,¹ the efficiency of which consisted in the attraction of the metallic particles evolved in the process of grinding. We believe that, to a certain extent, the object contemplated by it was attained, but it was never generally adopted; nor was it calculated to be of that service which the inventor and the public imagined. The dust, to which the artisan is exposed, abounds in gritty as well as metallic particles; and we have no reason to suppose, that the one is less injurious than the other. This ingenious contrivance would arrest the one kind of particles only—the metallic; consequently the grinder

¹ The ingenious invention was due to J. H. Abraham, F.L.S. It consisted in the arrangement of a series of magnets about the mouth.

would still be liable to the baneful influence of the other. We wish not to detract from the merit of the invention, which, as a first step towards improving the condition of this class of artisans, is worthy of commendation. The interest which was excited at that time led to inquiries and experiments which have continued to the present moment. Indeed, our own labours are only a sequel to the exertions of our predecessors; and without such exertions, as a guide and incentive, it is probable that this inquiry would never have been undertaken.

When we consider the uneducated and reckless character of many of the grinders, it is manifest, that any contrivance, to be generally and permanently useful, must be exceedingly cheap and simple in its construction; for were it either expensive or complicated in its nature, they would not spare means to purchase it, nor would they be careful to preserve it. We do not hesitate to assert, that if such an invention had afforded them complete protection, and had been furnished to them gratuitously, not one guard in six, in twelve months, would have been in use. They would not have given to it the little attention necessary to keep it in an effective state.

The knowledge of these facts suggested a plan, which is not less simple than efficient, and which the trial of years has proved to be equal to the thorough correction of the evil. A wooden funnel, from ten to twelve inches square, is placed a little above the surface of the revolving stone, on the side the farthest from the grinder, and this funnel terminates in a channel immediately under the surface of the floor; *or we may consider the channel simply as the continuation of the funnel*, in order to avoid any confusion in the explanation. The channel varies in length, according to the situation of the grinder, in reference to the point where it is most convenient to get quit of the dust. If we suppose that eight or ten grinders work in the same room, each has his own funnel and channel, *and they all terminate in one common channel, the capacity of which is perhaps twice or three times as great as each of the subordinate or branch channels.* The point where they terminate is always close to an external wall. At this point, within the general channel, a fan is placed, somewhat in form like that used in winnowing corn, and to this is attached a strap which passes upwards and over a pulley, so that whatever puts the pul-

ley in motion, causes the fan also to revolve. The pulley is placed in connexion with the machinery which turns the stone, so that whenever the grinder adjusts his machinery to work, he necessarily sets the pulley and the fan in motion. The fan, acting at this point, whatever may be the length of any of the subordinate channels, causes a strong current to flow from the mouth of each funnel, which carries along with it all the gritty and metallic particles evolved, leaving the room in which the operations are pursued, free from any perceptible dust. When the whole apparatus is perfect and in excellent condition, the atmosphere of the place is almost as healthy as that of a drawing-room.

In one manufactory,¹ where the apparatus is kept in beautiful order, the dust is thoroughly removed; and in this case it is conveyed by the general channel into a trough of water, on the outside of the building. The quantity which accumulates in it, in a few weeks, is very great; and in raising it in a mass, it seems to have almost the specific gravity of metal. The expense in the construction of the apparatus, would scarcely exceed the proportion of a sovereign to each grinder. The funnel will cost only a few shillings, and the channel, if the grinder work on the ground floor, may be formed by the excavation of the earth, placing bricks over it, or it may be formed entirely of bricks. The fan and the pulley may be purchased for a mere trifle.

It is much better that the subordinate or branch channels should be *under* the floor; if *above*, which they sometimes are, and in that case made of wood, they are constantly liable to accidents. They are kicked by the foot, broken by the stones, or otherwise injured. Where they are so exposed, the object contemplated in the construction of them is, in a great measure, defeated. The dust escapes into the room, and renders the atmosphere exceedingly impure. Were the legislature to interfere, and make it imperative on the part of the proprietors of wheels, to construct such an apparatus, and compel them to keep it in a perfect condition, an immense amount of disease, suffering, and wretched

¹ That of Messrs Yeomans and Shaw, spindle-manufacturers of this town. We have authority to state, that these gentlemen will be happy to show and explain to any visitor the system of ventilation which is efficiently carried out in the grinding of spindles.

ness would be prevented; and the future inquirer into the condition of grinders would not have to record the numerous premature deaths, which we shall subsequently bring under consideration. Government has interfered, and very properly, in compelling the mill-owners, in the cotton districts, so to *box off* the machinery, that accidents which were once frequent, are now of rare occurrence. The evils arising from the inhalation of gritty and metallic particles, are twenty times greater than could possibly be ascribed to unprotected machinery. The lives of thousands are shortened and embittered by the baneful occupation which we have described. And the injurious circumstances, in the one case, are as easily, and almost as cheaply corrected as in the other.

The efficacy of the plan is unquestionable. Where the apparatus has been in operation for years, we have not found a single individual labouring under any pulmonary affection; and the branch¹ in which we have observed this immunity, would otherwise have been exceedingly destructive to life.

A few of the more intelligent grinders have put up, at their own expense, an imperfect apparatus of this kind; and they have described to us in warm terms the benefit derived. In some instances, it has been done when the lungs had become affected with disease; and we know, from personal inquiry, that this has not only been arrested, but substantial relief has been afforded to the artisan. The plan, however, will never be generally adopted, or in any degree steadily maintained, unless enforced by special legislative enactments.

¹ The grinding of spindles.

CHAPTER VII.

THE PHYSICAL AND MENTAL CONDITION OF THE ARTISANS IN THE
SEVERAL BRANCHES OF GRINDING.

In the previous investigations we have been chiefly occupied in treating the subject in its medical relations; viz. the circumstances in which the disease occurs,—the action of the inhaled gritty and metallic particles,—the modifications in the character of the organic changes induced, and lastly, the pathology and treatment of them. Various other facts, elucidating the condition of this class of workmen, were evolved in the course of our extended labours, and which are too important to the legislator, the political economist, and the medical inquirer, to be overlooked. In the subsequent researches, we perceive the agency of various circumstances, which have not hitherto been brought into notice, on health, and the rate of mortality. The injurious nature of the occupation is unquestionably the absorbing inquiry; this, however, is associated with other considerations, such as the differences in the influence of the several branches on the animal system, and the corresponding modifications in the mental character and social position of the artisans. As we have previously remarked, the more destructive the branch, the more ignorant, reckless, and dissipated are the workmen; and the effects may be traced in the prevailing tendency to marry, and generally at exceedingly early ages. We propose to present these facts, in reference to each branch, and in doing so, shall occupy as little space as is consistent with the methodical statement and illustration of them.

SECT. I.—*Scissor-Grinders.*

In scissor-grinding, both the wet and the dry stone are used as in the grinding of razors; and the same remarks concerning the injurious nature of the occupation apply with general accu

racy to both. It would appear that the members of the former labour under peculiar hardships. The tools with which they work are various and expensive, and for wheel-room and steam-power, they are subject to a higher rent, if they employ an apprentice, than the fork, the penknife, or the razor-grinder, for the same advantage. To each of these, the annual cost for such accommodation is, L.12; to the scissor-grinder, L.16. He also complains, that he suffers severely from the immense quantities of cast metal scissors which are made, articles which leave a miserable remuneration, and are much more injurious to health than forged scissors, the dry stone being more largely employed in the one case than in the other, and further, a greater amount being ground in a given time to secure the merest pittance of wages.

The influence of these circumstances in the production of disease, and on the rate of mortality, will be rendered obvious by the analysis of numerous facts belonging to this particular branch.

The adult workmen are 213, and of the following ages:—

Ages.	Persons.
21 to 25	47
26 to 30	45
31 to 35	30
36 to 40	39
41 to 45	31
46 to 50	10
51 to 55	8
56 to 60	2
61 to 65	1

The ages of the workmen in any branch of trade are a general indication of the healthy or prejudicial nature of it. Where the circumstances are favourable, the average duration of life will be high; where otherwise, low. A very small proportion of the artisans are enabled to change their occupation. In the scissor-grinding branch 161 of the 213 are under 40 years of age, which is evidence of the destructive tendency of the business. Of the 213, 11 have not worked at the trade for several years, from different causes.

Ages.	Persons.
26 to 30	2
31 to 35	1
36 to 40	3
41 to 45	2
46 to 50	2
51 to 55	1

In addition to these facts elucidating the rate of mortality, we have the names and ages of the deceased in the branch since 1830. There are no records to be depended upon before this period; and of course, the returns are of such only as have died *pursuing* the occupation. The deaths within this time have been 102, and at the following ages:—

Ages.	Deaths.
21 to 25	6
26 to 30	22
31 to 35	13
36 to 40	28
41 to 45	17
46 to 50	11
51 to 55	2
56 to 60	2
61 to 65	1
<hr/>	
102	

According to these facts, 86 of the 102 have died under 45 years of age, and indeed five only exceeded 50. The rate of mortality would, however, have been greater, if 19 of the 102 had not been removed from four to seventeen years from the injurious influence of the business.

Ages.	Persons.	
26 to 30	2	Four and five years in the army and off the trade.
31 to 35	3	Four and six years off the trade.
36 to 40	3	Five, seven, and ten years in the army.
41 to 45	3	Twelve, fourteen, and seventeen years in the army.
46 to 50	5	Five, seven, seven, ten, and fifteen years in the army, navy, and out of the trade.
51 to 55	1	Nineteen years in the army.
56 to 60	1	Eight years out of the trade.
61 to 65	1	Ten years out of the trade.

To persons unacquainted with the ordinary rate of mortality at different ages, of the population generally in manufacturing districts, these figures will not convey a clear idea of the awfully destructive tendency of the occupation. To facilitate the apprehension of this truth, we will compare the deaths of the artisans in this branch with those occurring in the town at the same ages, and also with the deaths in agricultural counties. Such comparisons will exhibit the fact which we are anxious to impress upon the mind, in a form the most easy to be appreciated.

DEATHS at particular ages, out of 1000 deaths of Male Adults amongst the Scissor-Grinders, the Inhabitants of Sheffield generally, and in the Midland Counties.

Ages.	Scissor-Grinders.	Sheffield.	Midland Counties.
21 to 25	59 ¹	94	75
26 „ 30	215	90	74
31 „ 35	127	85	65
36 „ 40	275	83	58
41 „ 45	167	80	51
46 „ 50	107	80	55
51 „ 55	20	80	53
56 „ 60	20	81	74
61 „ 65	10	83	82
	<hr/>	<hr/>	<hr/>
	1000	756	587
Above 65	0	244	413
	<hr/>	<hr/>	<hr/>
	1000	1000	1000

How different are the results exhibited by these columns. Of the artisans in this branch, 843 out of 1000 die under 45 years of age; while in the town, where the rate of mortality is high, the number under this age is only 432; but in the agricultural counties, where the population is free from the influence of the various causes which in manufacturing towns are exceedingly prejudicial to health, the number of adults that die under 46 years of age is only 323, leaving out of the 1000 capable of the enjoyment of life 677.

In the next table similar results are arrived at by showing the proportions out of 1000 *living* at all ages above 21 years of age in this particular branch, in the town of Manchester,² and in the agricultural county of Northumberland.

AGES of Individuals out of 1000 living at all ages above 21 years of age.

Ages.	Scissor-Grinders.	Manchester.	Northumberland.
21 to 25	220	185	156
26 „ 30	211	161	138
31 „ 35	141	165	117
36 „ 40	183	116	106
41 „ 45	146	119	95
46 „ 50	47	69	84
51 „ 55	38	69	73
56 „ 60	9	34	65
61 „ 65	5	37	52
	<hr/>	<hr/>	<hr/>
	1000	955	881
Living above 65	0	45	119
	<hr/>	<hr/>	<hr/>
	1000	1000	1000

¹ This is an evident imperfection in the original return—an imperfection which it was not in our power to correct.

² The census of Sheffield, giving the above particulars, cannot be obtained; but the proportions in all large manufacturing towns present similar characteristics.

As the data adopted in the two preceding tables are not strictly correspondent, it is from the former only that we derive, by a peculiar process, the following table of the *remanets* of life, or survivors, at given ages, from a stated number of 1000 living at the age of 25, the facts previous to this age being altogether too irregular for the application of any rule. These are compared with the proportional numbers remaining at the same periods of life out of the whole population of Manchester, not having the census of the living of any other large manufacturing town, all of which, however, are very similar in their mortality, and seven-eighths of the returns are of the working classes.

Age.	Scissor Grinders.	Manchester.
Living at 25	1000	1000
Left at 30	945	931
„ 35	824	857
„ 40	610	782
„ 45	385	700
„ 50	232	612
„ 55	119	519
„ 60	41	423
„ 65	0	323

Many of the artisans in this branch are emaciated and shattered in constitution, and at an age considerably under the prime of life, owing to the pernicious nature of the pursuit. Of the 213, we found that 145 had suffered, or were at present affected with the following diseases:—

34 had been affected with inflammation in some part of the chest, which had required medical treatment; 24 had had spitting of blood; 27 had suffered from rheumatism, and often in a very severe form; 30 complained of some affection of the urinary organs, frequently pain in micturition, or the deposition of numerous small particles of sand; 12 had had fever, in most cases typhus; and 18 had unequivocal organic disease of the lungs, exhibiting difficulty of breathing, urgent cough, and expectoration. The grinders themselves never seem to be sensible of the incipient stages of pulmonary disease, though invariably accompanied with cough, and some degree of difficulty of breathing on exertion. They complain only when disease interferes with the ability to pursue the occupation.

The degree of education possessed by any class of artisans, is proportionate to their steady command of the necessaries of life, and their freedom from serious physical evils. When the wages

of labour are subject to great fluctuations, at one time more than equal to the sober wants of the workman, at another unequal to the imperative necessities of nature or the urgent claims of a family, it would be unphilosophical to expect any tendencies towards mental culture, or any decided aspirations towards virtuous pursuits. The masses of mankind cannot rise superior to the circumstances by which they are surrounded.

The educational condition of the scissor-grinders is low. Of the 213, 98 can read and write, but very indifferently; 17 can read only; and 98 can neither read nor write. When it is considered that more than half of these are under 35 years of age, living in a town where Sunday schools and free day-schools are numerous, it would scarcely be expected that 98 out of 213 adult artisans would not be able either to read or write. We regret to find that the apprentices in the branch are not much better educated. There are 117, of which number 7 are under 12 years of age; 33 from 12 to 15; and 77 from 16 to 20, and under 21. Of the 117, 60 can read and write; 15 can read only; and 42 can neither read nor write. These proportions exhibit only a small advance upon the adult artisans with respect to mental improvement.

The ages of these apprentices suggest a few remarks. The wages in every branch are modified according to the number of apprentices introduced in relation to the number of adult workmen. No branch can possibly maintain itself in a healthy condition, that increases its numbers beyond the regular and legitimate demands of the trade. Our inquiries have clearly established, that in those branches in which there are the fewest restrictions to the introduction of apprentices, the wages of labour are miserably low—the artisans are ignorant and wretched, and fitful periods of prosperity afford only a slight and temporary relief. The scissor-grinders, at this moment, are in great distress. Numbers of them are entirely without employment, and the rest have only about half work, and at prices 40 per cent. beneath what they received in 1831. The proportion of the apprentices to the adults, in this branch, is great, and the condition of the branch has been deteriorated by the influx of hands beyond the demand. From the mortality of the members, and the extension of the

trade, these circumstances cannot require 117 apprentices to 213 adults.

The number of apprentices, between 15 and 21 years of age, shows the effects of prosperity on the condition of a branch. When the demand, for a short time, is more than equal to the supply of hands, the workmen forget the lessons of experience. Recklessness takes the place of caution,—dissipation, that of sobriety. It is under these circumstances that apprentices are taken by the artisan, more frequently to enable him to gratify his love of idleness and of drink, than to improve his position; and the workmen themselves admit that the advice and discretion of the few are overruled by individuals of this class. 1834, 5, and 6 were years of prosperity, and the ages of the apprentices establish the fact. Of the 117,—77 are between the ages of 15 and 21, and would be part of those admitted during those years, and admitted when the number was already great, for 47 are found among the adults under 25 years of age, that would at that time, as well as many of the 45 between the ages of 25 and 30, be apprentices. Two-thirds of the 77 will soon pass into the ranks of the adults, to aggravate the existing distress, by increasing the disproportion between demand and supply. It is far from our desire to dwell on evils which cannot be corrected—which unfortunately are the inevitable accompaniments of manufactures. The many, whose fate it is to labour, will necessarily be in the rear of civilization—disfigured by vices, irregularities, and tendencies, which intelligence and the affluence of means in some degree restrain. We speak of physical evils, however, which do admit of correction, and in urging these on the consideration of the public, it is to excite sympathy, and we will not do the philanthropic the injustice to believe, that co-operation will be wanting, where the end to be attained is the diminution of human suffering in a numerous class of individuals, and by means simple, cheap, and efficient.

Of the 213 grinders in this branch, 154¹ are married, and were married at the following ages:—73 at 21 years of age, or under; 67 from 22 to 25; 11 from 26 to 30, and 3 from 31 to 35. In

¹ Six or eight refused to answer any question, so that the correct number is about 160.

comparing these returns with similar facts furnished by other branches of trade, we find the proportion of the married great, and especially at an early age. It appears that more than one-third are married at 21 and under, and there are only 14 married after 25 years of age. Indeed, 35 of the 73 are married at 20 and under. It is scarcely necessary to remark, that, in any branch where so large a proportion marries before, or immediately after the termination of apprenticeship, the artisans generally must be exceedingly ignorant. The act, at that early age, and under such circumstances, is the certain precursor of much suffering and destitution. There is no preparation for the necessities of the future. They commence life in difficulties, and they continue to be familiar with them during the short period they exist, aggravated at every advancing stage with additional evils. It cannot be a matter of surprise that, in manufacturing districts, where such causes are in operation, civilization should stand still, or at times retrograde. The causes did not always exist in the same degree.

There is another circumstance connected with this class of artisans, which is further evidence of their degraded condition, and that is the class of individuals whom, to a great extent, they marry. Girls and women are employed in many of the departments of trade carried on in this town, and as they are frequently mixed indiscriminately with the men, or have ample opportunities of association, they are often extremely vitiated or debased in character. Of domestic affairs, they know scarcely any thing. We imagined, from some general observations, that the lower the mental condition of a branch, the greater is the proportion of shop girls married by the artisans belonging to it. To determine this point, we made it a particular inquiry, and found such generally to be the fact. The shop girls, from their ability to earn something, are regarded by the ignorant and thoughtless artisan as possessing peculiar advantages, worthy of his consideration. Of the 154 married in this branch, 81 married shop girls.

There are also two other facts fraught with some interest, in connection with this branch, viz. the number of children born to the 154 artisans, which is 598; of this number, 369 are living, and 229 dead. There are 17 of the 154 who have no children,

and of this number 8 are under 24, two under 30, six under 40, and one under 50 years of age. Nature appears not only precocious, but extremely fruitful in this branch. We shall now briefly compare the condition of it with another in the town, much less injurious to life, in which the workmen stand high for their general intelligence and good conduct, and in which the wages are neither extravagantly high at one time, nor exceedingly depressed at another, viz. the saw manufacture. We have accurate returns of 142 adult workmen; the trade comprises, however, about two hundred:—

21 to 25	.	.	.	44	51 to 55	.	.	.	6
20 „ 30	.	.	.	23	56 „ 60	.	.	.	6
31 „ 35	.	.	.	24	61 „ 65	.	.	.	1
36 „ 40	.	.	.	13	66 „ 70	.	.	.	2
41 „ 45	.	.	.	14	71 „ 75	.	.	.	2
46 „ 50	.	.	.	6	76 „ 81	.	.	.	1

The married are 92 of the 142, and at the following ages:— At 21 and under, 39; from 22 to 25, 41; from 26 to 30, 11; and 1 at 41. In this branch a much less proportion is married under 21 than among the scissor-grinders. A greater proportion is also nearer 25 years of age at marriage in the former than in the latter department of trade,—facts which are not indicated by the figures given. Among the 142 adults, there is only one that can neither read nor write. The children born to the 92 are 451; the living, 290; the dead, 161.

The proportion of the 142 that is, or has been, afflicted with disease, since they entered the trade, is 25; 9 of inflammation or disease of the lungs or air-passages, 4 of fever, 4 of rheumatism, 2 of inflammation of the brain, and 6 of other diseases. Among the scissor-grinders, the proportion was 145 in the 213, exhibiting a remarkable difference in the amount of suffering in these two trades. The scissor branch is by no means the most injurious of the grinding departments. In the saw manufacture, 12 only of the 92 married shop girls; whereas among the scissor-grinders, 81 in 154. There is another fact in connection with the saw-makers, which it is important to mention, viz. the age at which the 142 entered upon the business. Under 13 years of age, 17; from 13 to 14 inclusive, 105; above 14, 20. We have not the same facts with respect to the scissor-grinders, but shall adduce them in connection with the other branches of grinding.

We have no hesitation, however, in stating, that more than half of the 213 scissor-grinders were engaged in the trade before 11, and many, we regret to say, at 8 and 9 years of age.

SECT. II.—*The Fork-Grinders.*

Such is the destructive tendency of this branch, that grinders in other departments frequently refuse to work in the same room, and many sick clubs have an especial rule against the admission of them, as they would draw largely on their funds, from frequent and long-continued sickness. We will proceed to analyse the following facts, bearing on the condition of this branch.

The men employed,	.	.	.	.	.	.	.	97
The boys ditto,	.	.	.	.	.	.	.	100
The number of men from 21 to 25 years of age,	.	.	.	.	.	.	.	28
" " 26 to 30 "	.	.	.	.	.	.	.	28
" " 31 to 35 "	.	.	.	.	.	.	.	8
" " 35 to 39 "	.	.	.	.	.	.	.	14
" " 40 and upwards,	.	.	.	.	.	.	.	19
								— 97
The number of boys from 10 to 14 years of age,	.	.	.	.	.	.	.	39
" " 15 to 19 "	.	.	.	.	.	.	.	51
" " at 20 "	.	.	.	.	.	.	.	10
								— 100

Amongst the 19 men above 40 years of age, there are only 3 who have attained 50 years ; and it is remarkable that 10 of the 19 either commenced this kind of work late in life, or passed several years in the army, as the following particulars show :—

A, 64 years of age,	was 25 when he began the trade ;
B, 54	" was 30 " "
C, 55	" was 26 " "
D, 50	" was 6 years in the army ;
E, 48	" was 23 " "
F, 58	" was 10 years out of the trade ;
G, 48	" was 24 " "
H,	was unable to work from lameness ;
I, 40	" was 10 years a gamekeeper ;
J	was 10 years out of the trade.

Deducting these 10 from the 97, there are 56 under 30 years of age ; 8 from 30 to 35 ; 14 from 35 to 40 ; 9 above 40 and under 50 ; and in the class from 35 to 40, there are some who have not worked regularly at the trade from youth. The distribution of numbers at these different ages, shows the extraordinary mor-

tality that must take place. What an immense proportion must die under 30 years of age! There are 56 under 30, and only 8 from 30 to 35; consequently it is manifest that the greater part of the 56 die before attaining 30 years of age.

We have the names and ages of those who have died within stated periods,¹ and hence unquestionable evidence of the rate of mortality. The number of workmen in the branch in 1820 was 80, and the deaths in the five following years were 20, and at these ages:—

21 to 24,	6;
25 to 29,	6;
at 31,	2;
at 34,	3;
at 40,	1;
at 50,	1, entered the trade at 24;
at 50,	1, 23 years in the army.

Thus, of the 20 deaths, 17 were of persons under 35 years of age. There are no records of the deaths of those under 21 years. At that period, one-fourth of the number employed died every five years,—a rate of mortality exceeding every thing previously known in any branch of manufacture, or in any pursuit or occupation. We have also the names and ages of 61 persons who died from 1825 to 1840, and we observe the same melancholy facts.

4	at	22
5	"	24
13	"	26
7	"	28
6	"	30
9	"	34
3	"	36
7	"	38
3	"	40
3	"	46
1	"	48

Of the 9 who attained the age of 34, 1 was 10 years a sailor; the one 48 years of age, was 15 years in the army. Of the 3, 46 years of age, 1 was 12 years a soldier; and another commenced work at 23. Of the 7, 38 years of age, 1 was 10 years engaged in another pursuit.

According to these facts, 35 of the 61 died under 30 years of

¹ We have no account of the number who have left the trade, or that die unconnected with the union of the particular branch, from one given period to another.

age; and under 36 years, 47. Of the remaining 14 above 36 years of age, 4 are to be deducted, either from having commenced the business late in life, or from having been withdrawn from the influence of it for a series of years. We do not hesitate to assert, that this is such a picture of wretchedness (for life can be thus abridged only by a process of misery,) that has no parallel in the annals of any country, or in the records of any trade; but these figures will not convey to readers generally, a correct idea of the extraordinary rate of mortality, unless compared with the ratio of deaths at different periods, above 21 years of age, in this town, and in the country generally. It is only by such comparisons, that just notions can be formed of the awful destruction of human life in this particular branch.

COMPARISON OF DEATHS, at particular ages, out of 1000 deaths of Persons above 20 years of age, in England and Wales; in Sheffield generally, and of the Fork-Grinders particularly.

Ages.	England and Wales.	Sheffield.	Fork-grinders.
20 to 29,.....	160	184	475
30 „ 39,.....	136	164	410
40 „ 49,.....	126	158	115
50 „ 59,.....	127	155	0
20 „ 60,.....	549	661	1000
At all ages above 20,.....	1000	1000	1000

Thus, out of 1000 deaths of persons above 20 years of age, the proportion between 20 and 30, in England and Wales, is 160; in Sheffield, 184; but amongst the fork-grinders, the proportion is the appalling number, 475; so that between these two periods, three in this trade die to one in the kingdom generally.

Between the ages of 30 and 40, a still greater disparity presents itself. In the kingdom, 136 only in the 1000 die: in Sheffield 164; but in the fork-grinding branch, 410; so that between 20 and 40 years of age, in this trade, 885 perish out of the 1000; while in the kingdom at large, only 296. Another step in the analysis, and we perceive that between 40 and 50, in the kingdom, 126 die; in this town, 155; and in this branch, 55, which completes the 1000. They are all killed off. For in

carrying forward the inquiry, we observe that between 50 and 60, in the kingdom, 127 die; and in Sheffield, 155; but among the fork-grinders, there is not a single individual left. After this period of life there are remaining in the kingdom, of the 1000, 441; and in the town, 339, but none in this branch of manufacture.

Of the 197 men and boys, 109 can read only, and generally very imperfectly, and 69 can write. We have particulars of the condition of 77 of the 97 adult workmen, which we shall proceed to analyse. Of the 77, 58 are married, and were so at the subjoined ages; 35 at 21 and under; 23 from 21 to 25. Among the former, nearly two-thirds were married under 21, and of the latter, more than two-thirds under 23 years of age. This department of grinding is by far the most destructive of any carried on in the town, and the various facts, which we shall state in connexion with it, will exhibit a proportionally degraded condition of the artisans, in whatever light they are regarded. Of the 58,—33 married shop-girls, which is a large proportion, and is evidence of the low mental condition of the workmen. The number of children born to the 58, is 223; living, 132; dead, 91. The ages at which the 77 entered upon the business of grinding were as follows:—35 at 9 years and under; 17 at 10 and 11; 17 at 12 and 13; 8 at 14 and upwards. Hence it appears, that nearly one-half commence grinding at and before the age of 9. Such facts satisfactorily account for the large amount of ignorance, recklessness, and destitution pervading the artisans in this branch.

The 77 were, at the time of our inquiries, either suffering from, or had been affected with the following diseases:—13 from inflammation of the lungs and air-passages; 7 from rheumatism; 5 from spitting of blood; 4 from disorders of the urinary organs; 12 from various affections; 27 were affected with permanent disease of the lungs; and many of the individuals were in the last stage of wretchedness and suffering.

SECT. III.—*Needle-Grinders.*

The branch which next falls under consideration is that of needle-grinding. This is not extensively carried on in Sheffield; and it is only of late years that it has been introduced amongst us. The needle manufacture has, for a very long period, been seated at Hathersage in Derbyshire, and is at present conducted with spirit by several enterprising capitalists. The business was introduced into this town from Hathersage. Our personal observations were made in a visit to the manufactories of the latter place, the field for inquiry being far more extensive than the one at home.

We had frequently heard of the pernicious tendency of this particular occupation, and though prepared to believe much, from elaborate investigation into similar pursuits, we candidly admit, that the physical evils produced by it exceed all that imagination had pictured. We had no conception that men could be found so reckless of consequences, as to engage in the trade, when protracted suffering and death were the certain results.

The grinding departments in this town differ in several respects from the needle branch. In the former, the youths taken as apprentices are always young, and they require considerable teaching and practice to make them of any value. In the latter, this is not the case. The new hands are young men from 17 to 20 years of age, rough and uncultivated from the plough; and in those manufactories where ventilation is not secured, they are dead before the age of 30, perhaps after two or three years of suffering. A regulation has always existed at Hathersage, and which alone is evidence of the awfully destructive influence of the occupation, limiting the hours of work to six per day. If this had not been adopted, men would not have been found hardy enough to fill up the vacancies constantly occurring in the ranks of their fellows, occasioned by death. What must we think of a branch, in which the workmen are employed only half the day, having the rest for gardening and amusements, and yet the majority of them are killed off below 30 years of age; men who enter upon the business with vigorous constitutions,

and at a time of life when the animal system possesses considerable energy?

In the examination into the influence of this branch, we have not the advantage of numerous individuals, as data on which to reason, or as facts to analyse. The numbers employed are not great, one person being capable of grinding an immense quantity of needles.

The number of needle-grinders at Hathersage, in 1822, was 7; in 1832, 14; and in 1842, 23. The following returns give the respective ages of them, and the time when they began to work at the business.

Age of each.	Age at which each respectively began this work.
19	14
19	16
19	16
21	19
22	15
22	15
23	16
23	17
23	18
25	24 $\frac{3}{4}$
26	14
26	17
26	18
26	18
26	18
26	19
27	18
27	20
30	21
30	21
31	22
35	18
41	32

The average age of the 23 is $25\frac{3}{4}$; that at which they began the business, $18\frac{1}{4}$. From these facts alone, it would appear, that needle-grinding is exceedingly destructive to human life. Were such not the case, we should observe, as in all other branches of manufacture, much older individuals than any in the preceding list. The ages of the living, in every pursuit, have an inversely modified relation to the rate of mortality; and we do not hesitate to assert, that no long established occupation in the united empire,—an occupation in which the demand for hands has increased, will present any thing like the same melancholy results.

Hands have not been removed for want of employment; for, in Hathersage alone, the number has been more than trebled in twenty-two years.

We have the names and ages of the deceased, since 1822, at Hathersage; and the period is also stated at which they became needle-grinders. We have correct information of the nature of the diseases of which the following twelve died. The first nine on the list died of the grinders' disease.

Age commencing this business.	Age at Death.
14	27
14	28
14	32
17	28
17	30
18	36
18	42
20	37
21	26
15	20
15	20
26	42

Four that were working at Hathersage in 1832 subsequently left, and we have no records of them.

The number of needle-grinders at Sheffield is ten; and the following particulars are all that we have been able to glean respecting them. We have, unfortunately, no information concerning the deceased here.

Age of each.	Age at which each respectively began this work.
16	14
18	15
22	16
22	18
22	19
27	19
27	19
33	31
27	10 (3 years off the business.)
34	16 (8 years off the business.)

These 10 present the same general facts as the preceding 23. The average ages of them, and the period at which they enter the trade, differ little in the two situations. Had not the occupation been a great leveller of human life, a difference would have been anticipated, the trade having long been carried on at

Hathersage, and being of recent origin in this town. The needle-grinders here are not under the same regulation respecting the hours of labour, as at Hathersage: they generally work the whole day.

We have further particulars to state respecting the deceased at Hathersage. When the grinder is exceedingly ill, suffering from a constantly distressing cough, and great difficulty of breathing—symptoms which usually continue for several years—he follows his occupation until his strength is quite unequal to any exertions. At this moment, he is a miserable object:—His figure is bent forward, his looks haggard, his frame emaciated, and a train of other symptoms, indications of wretchedness, are obvious to the superficial observer.

The following facts relate to the nine deceased persons at Hathersage. They show how long they suffered after being *incapacitated* from pursuing the trade: and what number of children they left,—additional reasons for urging on the consideration of the public the physical evils of this important class of artisans.

Months of Illness.	Family left.		
7	Wife and six	children.	
36	...	two	...
9	...	seven	...
18	...	four	...
24	...	four	...
1½	...	three	...
7	...	four	...
16	An orphan.		
14	Two orphans.		

These nine individuals had, in all probability, been affected for several years with disease of the lungs, before they became unequal to further exertion; and yet the average of individual suffering, previous to death, was fifteen months. Every grinding branch presents similar cases. The needle-grinders are ignorant and mostly dissipated. One half can neither read nor write.

The dust which is evolved, in the process of needle-grinding, contains a much larger amount of steel than is produced by any other kind of grinding. From one manufactory, where the benevolent and enlightened proprietor¹ has introduced an excellent ventilating apparatus, we collected masses of the dust which had accumulated in various parts of it, that had nearly the spe-

¹ Mr Cocker, Hathersage.

sific gravity of pure metal. To this gentleman we were much indebted for the readiness with which he entered into our investigations, and for the facilities which he afforded to our labours. At a cost of nearly two hundred pounds, he has recently fitted up a machine to ventilate the grinding-room, and to a great extent it is effectual in removing the dust created.

SECT. IV.—*Razor-Grinders.*

The various departments of grinding have many relations in common, such as the pernicious character of the occupation—the appalling rate of mortality, and the painful effects of aggravated competition; but razor-grinding is unquestionably accompanied with greater evils than any other, excepting the two latter branches which have been considered. The greater severity of it may, perhaps, not fully appear in the following tables, the cause of which may be readily explained. The more extensive any department of trade, the more loosely the artisans are associated by principles of combination, and, consequently, the more difficult it is to collect statistics elucidating the condition of it. Such is precisely the case with the branch under consideration. The members are numerous, widely scattered, and imperfectly united; hence the difficulty of arriving at particulars spread over an extended series of years. These circumstances do not affect the accuracy of the individual results obtained; only the completeness of the inquiry. The faults with which it may be charged will be those rather of omission than of commission.

Razor-grinding differs in several essential respects from the two latter branches which have been studied. It is much more laborious than either, requiring, in some of the stages, a continual concentration of muscular power; and, at the same time, the trunk is bent at a right angle over the revolving stone, a position which is peculiarly unfavourable to respiration.

The back and the tang, or small end of the razor, are invariably ground on a dry stone, the rest on a wet one. In the latter process, which is generally regarded as free from injurious effects, it is stated, however, by the artisan, that a gaseous matter is evolved, not only exceedingly disagreeable, but prejudicial, and

which, from the inclined position of the body, is necessarily inhaled.

In this department of grinding, especially in the better kind of goods, there is ample play for skill; and a few only of the trade are equal to the superior work. The expenses of wheel rent and tools fall heavily on this branch. The wheel rent is a charge common to every class of grinders, but in this a great variety of tools is required, and the expenses are proportionately increased. For one trough, or the steam power for an adult workman, the annual rent is eight guineas; if he has one apprentice, four guineas additional; if two, his expenses, independently of tools, simply for the means of pursuing his avocation, are twenty guineas. In a season of prosperity, the pressure of these burthens may be borne, but it is fraught with ruin and embarrassment in a period of commercial distress. A small income and a large expenditure gradually break down the physical and the moral condition of the artisan; and the effects are often beyond the remedy of returning prosperity.

We proceed now to the analysis of the branch. The adult workmen employed are 275, and of the following ages:—

21	to	25,	.	.	102
26	to	30,	.	.	52
31	to	35,	.	.	41
36	to	40,	.	.	41
41	to	45,	.	.	19
46	to	50,	.	.	14
51	to	56,	.	.	6

These figures are alone sufficient to establish an appalling rate of mortality. Of the 275, 154 are actually under 31 years of age; and above 45, there are only 20. The rapid decadency in the numbers, before the prime of life, is not to be ascribed to the artisan's quitting this pursuit for some other less prejudicial to health, but to the destructive tendency of the occupation. Among the 275 are many who have passed several years in the army, or have been otherwise employed, by the deduction of which, the foregoing picture would present even darker outlines. Of this number are the following:—

3	of the	41	from	31	to	35
3	"	41	"	36	"	40
4	"	19	"	41	"	45
5	"	14	"	46	"	50
3	"	6	"	51	"	55

Thus 18 of the 121 above 30 years of age, have been withdrawn from the influence of the trade, for different periods, varying from 5 to 18 years. In addition to these particulars, establishing by implication the great mortality of the branch, there is further evidence bearing directly on this subject; viz. the deaths from 1822 to 1841, inclusively. We have the names and ages of 182 who have died within this period, above 21 years of age, and the following table, as far as it goes, may be regarded as correct. The ages at which the 182 died were,—

21	to	25,	.	.	22
26	„	30,	.	.	39
31	„	35,	.	.	38
36	„	40,	.	.	37
41	„	45,	.	.	25
46	„	50,	.	.	9
51	„	55,	.	.	6
56	„	60,	.	.	5
61	„	65,	.	.	1

These returns have been obtained with difficulty; and when it is considered that the deaths are spread over twenty years, it is not extraordinary if we have failed to record all.

Before proceeding to exhibit by comparison the awful rate of mortality which these numbers indicate, we must press on the attention of the reader other particulars in connexion with them. Many of the 182 had passed several years in the army, or had been otherwise employed; and some had been killed by the breaking of the stone while at work.

2	of the	22	from	21	to	25	killed by the breaking of the stone.
4	„	39	„	26	„	30	in the army, or otherwise employed.
5	„	38	„	31	„	35	do. do.
6	„	37	„	36	„	40	do. do.
6	„	25	„	41	„	45	do. do.
5	„	9	„	46	„	50	do. do.
4	„	6	„	51	„	55	do. do.
3	„	5	„	56	„	60	do. do.

The periods during which the above were withdrawn from the influence of the trade were various. Of this number 17 were from 5 to 10; 9 from 10 to 15; 5 from 15 to 20 years. Appalling as the rate of mortality is, according to the returns of death, the analysis of these returns reduces still further the average

duration of life ; exhibiting, to a lamentable extent, the wretchedness and suffering of an important class of human beings.

DEATHS, at particular ages, out of 1000 at all ages above 20, of the Razor-Grinders, and of the Inhabitants generally of Sheffield :—

Ages.	Razor-Grinders.	Sheffield.
21 to 25	121	94
26 „ 30	215	90
31 „ 35	209	85
36 „ 40	204	83
41 „ 45	137	80
46 „ 50	49	80
51 „ 55	33	80
56 „ 60	27	81
61 „ 65	5	83
		<hr/>
		756
Above 65	0	244
	<hr/>	<hr/>
	1000	1000

How striking is the contrast between the two columns ! Had a third been added, presenting the mortality in agricultural districts, the disparity would have been far greater. The uniformity of decrease in the numbers at consecutive periods of life, in the town, is remarkable.

Among this class of grinders, 749 out of 1000 die under 41 years of age, but in the town only 352, actually less than one-half ; so that after this period, of the former, the remaining mortality is 251, but of the latter 648, even where the rate of mortality is great compared with that prevailing in agricultural districts.

The next table corroborates the justness of the foregoing remarks. In the one given, the deaths at different ages are recorded, as far as it has been in our power to ascertain them ; and in the following table, the proportion of the razor-grinders, living at all ages above 21, is also given, which, in this case, is calculated upon returns which are not only accurate but complete.

The two columns, exhibiting the proportions, at different ages, in Northumberland and England generally, are added, as exhibiting a striking contrast to the distribution of the numbers in the first column.

Ages of individuals out of 1000 living at all ages above 21 years :—

Ages.	Razor-grinders.	Northumberland.	England.
21 to 25,	371	156	157
26 to 30,	189	138	141
31 to 35,	149	117	124
36 to 40,	149	106	111
41 to 45,	69	95	101
46 to 50,	51	84	89
51 to 55,	22	73	74
	<hr/>	<hr/>	<hr/>
	1000	769	797
Above 55,	0	231	203
	<hr/>	<hr/>	<hr/>
	1000	1000	1000

The comparison of the first with the other two columns, establishes, by inference, the awful mortality among this class of artisans. From 21 to 40 years of age, of razor-grinders, there are existing, 858 of the 1000; in Northumberland, 517; and in England, 533. At 56 years of age, the razor-grinders have altogether disappeared, after which period of life, in Northumberland 231, and in England 203 exist of the 1000. We are anxious that these facts be clearly understood, anticipating that the time is not far distant, when the legislature will deem it necessary to interfere, to arrest the progress of evils which admit, to a considerable extent, of the application of efficient remedial measures.

In the investigation of the mortality and disease of the razor-grinders, we have left out of consideration one circumstance, which affects the character of the aggregate results, bearing on both subjects, and which it is interesting to note. A portion of these grinders live and work in the country, using water and not steam power. In the town the latter is almost exclusively in operation. The former is uncertain; at one time inactive, from a deficiency—at another from a superabundance of water; consequently, the artisans who depend upon it have frequently a good deal of time at command, which is spent in gardening, or in agricultural pursuits. The rooms in which they work are also more airy than in the town, from the open situation of the wheels, and the neglected state of the windows. These circumstances modify, in an important degree, the preceding calculations. They render the rate of mortality, and the amount of disease, more favourable than they otherwise would be. The re-

turns of the ages of those who have died in the country, as well as the ages of those at present following the occupation, establish the fact. The returns of the deaths in the country are 22.

Ages.	Deaths.
From 21 to 30,	4
„ 31 to 35,	1
„ 36 to 40,	5
„ 41 to 45,	3
„ 46 to 50,	1
„ 51 to 55,	4
„ 56 to 60,	3
„ 61,	1

These returns are much more favourable than the general results presented. Out of 22 deaths, 5 only are under 35 years of age, and 8 of the deaths exceed 50 years. This is indeed a striking disparity to the prevailing rate of mortality in the branch generally.

The adults working in the country, and partly employed in agriculture, are 18.

Ages.	Persons.
26 to 30,	4
31 to 35,	2
36 to 40,	1
41 to 45,	4
46 to 50,	1
51 to 55,	3
56 to 60,	3

Nearly two-thirds of these are above 40 years of age, showing the duration of life to be far greater than would be indicated by the same number taken indiscriminately from the 275 adults.

The 18 artisans are partly employed in agricultural pursuits. The whole number working in the country is about 50 adults, together with about 40 apprentices, and are included in the general returns and calculations; so that nearly one-fifth of the grinders are much less exposed than the members generally to the baneful influence of the trade. Were such deducted, the rate of mortality in the branch would be greatly increased.

Inseparably connected with the preceding inquiries concerning the mortality and disease of this class of artisans, is their mental condition. A concentration of the entire energies of a class to procure the common necessities of life, and which are obtained with difficulty and suffering, is incompatible with intellectual improvement. Ignorance and physical evils go hand in hand. They react on each other, being both causes and effects.

The proportion of the 275 that can read and write is 84; that can read only, 51; so that 140 adults, out of 275, can neither read nor write. Such is the condition of a numerous and important class of individuals, co-existing with growing opulence,—the love of display, and the extension of commercial enterprise.

The apprentices are 123: from 10 to 15 years of age, 55; from 15 to 20 inclusive, 68. The number that can read and write, 50; that can read only, 26. The physical and mental condition of a branch may be determined with considerable accuracy, from the proportion of the apprentices to the adults. Where this is great, low wages, poverty and misery, are inevitable. The introduction of numerous apprentices into a branch modifies the condition of it, much in the same manner as the introduction of machinery; the productive power is augmented, and is constantly receiving additions, until at length it vastly exceeds the demand. Every step towards this result cheapens labour, and degrades the position of the artisan.

A fit of prosperity is always accompanied with a degree of intoxicating influence, affecting equally the manufacturer and the artisan. They both lay aside the sober calculations of experience, and regard the immediate future as unlike all other futures which they have ever contemplated.

When the demand exceeds the means of supply, the artisan sees no wisdom in restrictions which maintain at a remunerating point the value of his labour. To gratify his love of ease or indulgence, the laws regulating the admission of apprentices are relaxed, and the young are introduced, not according to any natural or average demand, but in accordance with a temporary and excited impulse; and the increase continues until the supply oversteps the wants of the market. The artisan then makes the important discovery, that he has reduced the value of his labour to the starving point, by the reckless introduction of apprentices. He enters upon a series of difficulties, embarrassments, and sufferings; and painful as the fact is, relief can arise only from the gradual destruction of the surplus hands, by poverty in all its harrowing forms, exhaustion from over-taxed exertion, dissipation, and the poisonous effects of the occupation. When the ranks are considerably thinned, he gradually rises in value, and by very tedious degrees resumes his former position.

The number of adults and apprentices at different periods will establish, by comparison, the correctness of this reasoning, and the facts on which it rests are worthy of attention.

A.D.	Adults.	Apprentices.	Total.
1810,	76	89	165
1814,	124	103	227
1826,	162	111	273
1832,	188	110	298
1837,	228	228	456
1842,	275	123	398

From 1826 to about 1831, trade was in a depressed condition, and the effects were felt by all classes of society. The evidence of it is manifest in the slight increase in the hands during this period. The adults had increased only 26, and the apprentices had diminished 1. From 1832 to the middle of 1836, trade generally revived, until a degree of speculation and enterprise prevailed, exceeding that of every previous period of excitement.

During this short period, the adults increased from 188 to 228, and the apprentices from 110 to 228. The addition to the adults was as great as could be drawn from the existing number of apprentices. Of the 110, perhaps only 60 or 70 could become of age in the space of five years. The adults had increased 40 during the period; and, in the same time, would probably lose by death about 30. Supposing 70 to pass into the class of adults, the apprentices increased in the five years 188, being the differences between 110 and 228×70 . How vast is this addition compared with that of any preceding period! The productive power in five years was nearly doubled.

From 1836 to the present time, we have had one uninterrupted series of commercial difficulties; a diminished demand co-existing with an augmented supply of hands; hence the poverty, struggling, and misery of this class of artisans. Much of the wretchedness is to be ascribed to their own folly.

How different are the numbers in the past five years, from the preceding five. The adults have increased 47,—from 228 to 275; and allowing fifty to have died, in the mean time, or otherwise disposed of, which is a moderate calculation, taking into consideration the prevalence of severe distress, 97 would pass from the class of apprentices into that of the adults, leaving in the former 131. In the existing number (123) of apprentices, 60 are under sixteen years of age, which must be regarded as

added within the last past five years; hence 60 added to 131 would give, as the present number of apprentices, 191, and yet the number is only 123, leaving 68 unaccounted for.

The circumstances which abridge the life of the adult fall also with peculiar severity on the young employed in the trade.

We have ascertained that 195 of the 275 are married, and at the following ages:—

Age.	Persons.	Age.	Persons.
18	2	25	15
19	13	26	6
20	27	27	5
21	34	28	4
22	37	29	1
23	29	30	2
24	22	31	1

This list is not complete, owing to the difficulty of obtaining particulars of many individuals, who, from various circumstances, could not be visited. We had returns, showing that 44 of the 197 had married shop girls. At the time of our inquiry, the numbers suffering from disease, were as follows: 44 affected with permanent disease of the lungs or air-passages; 4 with inflammation of the lungs; 8 with rheumatism; 8 with spitting of blood; 9 with disease of the urinary organs; and 12 otherwise variously affected. Did the same class of grinders always work together, the figures indicating the amount of disease and the rate of mortality would be an exact measure of the destructive nature of the particular pursuit; but as individuals of the different branches are indiscriminately mixed, the clouded atmosphere, which is common to all in the same room, will modify, to some extent, the accuracy of such a measure. The great evil is unquestionably the dust which is immediately evolved from the stone to which the artisan is exposed.

SECT. V.—*Pen-Knife Grinders.*

The pen-blade grinders use both the dry and the wet stone; and though they create less dust than the fork-grinders, yet the atmosphere to which they are exposed is exceedingly injurious, from the different branches of grinding being carried on in the same room. The destructive tendency of the trade is placed in

a strong point of view by the analysis of the ages of those employed; whence a general idea may be formed of the rate of mortality. The number of men in this branch is 319, and of the following ages:—

21	to	25,	.	.	124
26	"	30,	.	.	73
31	"	35,	.	.	25
36	"	40,	.	.	42
41	"	45,	.	.	31
46	"	50,	.	.	12
51	"	55,	.	.	8
56	"	60,	.	.	4
					319

This table, the general accuracy of which is unquestionable, is the result of considerable labour, having procured the name and age of every person employed. What an awful picture does it present! 295 of the 319 adults are under 46 years of age, leaving only 24 above that age. Many of the 319 have not been constantly employed in the trade. Some have passed several years in the army or navy, or in other occupations less destructive to life.

7	of the	124	are of this number.	
6	"	73	"	"
1	"	25	"	"
5	"	42	"	"
6	"	31	"	"
3	"	12	"	"
2	"	8	"	"
3	"	4	"	"

Thus 33 of the 319 have, for various periods, been removed from the baneful influence of the trade. Of the 24 above 46 years of age, 8 are of this number; so that 16 only, of 294 regularly pursuing the occupation, are found employed after 46 years of age. Perhaps it would scarcely be correct to argue that these facts furnish an exact scale of the rate of mortality, some few individuals having retired, owing to disease and other causes, from the trade. They convey, however, a general idea of the sweeping mortality of the branch.

On this part of the subject, it is in our power to throw further light, having the names and ages of 67 pen-blade grinders, who have died since 1832.

This branch not having been in perfect union for many years,

it has not been possible to procure correct returns of all who have died, or particulars belonging to many of the 67, with the names and ages of whom we are furnished. The following facts may, nevertheless, be depended upon :

The AGES of the 67 who have died since 1832.

21	to	25,	.	.	12
26	„	30,	.	.	15
31	„	35,	.	.	14
36	„	40,	.	.	8
41	„	45,	.	.	6
46	„	50,	.	.	8
51	„	55,	.	.	1
56	„	60,	.	.	3
					<hr/>
					67

Several of these had not been regularly employed in the trade. The following had served different periods in the army :

A	at	34,	.	.	10 years.
B	„	46,	.	.	11 „
C	„	57,	.	.	15 „
D	„	49,	.	.	19 „
E	„	53,	.	.	20 „
F	„	58,	.	.	20 „

According to these facts, or the particulars from which the preceding summary is derived, 52 of the 67 died under 42 years of age; and of the 15 above this age, 5 are to be deducted, as not having worked regularly at the business, consequently, not subject to the destructive agencies of it.

We shall now proceed to compare the proportions, at different ages, of the adults at present employed with those who have died within the past ten, or rather nine years and a half.

PROPORTIONS out of 1000 Living and 1000 Dying, in the nearly parallel periods of life expressed, amongst the Pen-Blade Grinders of Sheffield, and the Male Adult Inhabitants of England and Wales generally.

Pen-blade Grinders.			Males of England and Wales.		
Ages.	Living.	Dying.	Ages.	Living.	Dying.
21 to 30,.....	617	402	20 to 29,.....	296	151
31 to 40,.....	211	329	30 to 39,.....	233	134
41 to 50,.....	134	209	40 to 49,.....	189	134
51 to 60,.....	38	60	50 to 59,.....	134	135
61 and upwards,...	0	0	60 and upwards,...	148	446
	1000	1000		1000	1000

Not having the numbers of living and dying in strict parallelism of date, the rate of mortality is not readily apparent in the first division of the table. The rate of mortality in England and Wales, of male adults, is about 1 in 50 annually, so that multiplying the living in the second division of the table by 50, we arrive at a just comparison between the living and dying; the multiplier, however, is liable to a certain degree of fluctuation. It is necessary to remark, that we have not sufficient data to infer, in the same way, the exact rate of mortality of the adults in the pen-blade grinding department; we give all the elements for such calculation, which it has been in our power to procure.

The preceding facts were the result of an inquiry instituted in 1841, since which time we have again investigated the branch, but have found no important modifications worth remarking. The adult grinders have increased from 319 to 333. We have ascertained that of the latter number, 128 were married at and under 21 years of age, 100 from 21 to 25, 14 from 26 to 30, and 3 from 31 to 35. This list, however is not complete. Many individuals, from being out of employment, could not be met with. Of the 245 married, 98 married shop girls. The number of children born, 1099; the living, 689; the dead, 410. When we consider that far more than half of this class of artisans are under 30 years of age, the number of the children born is great. The grinders suffering from structural changes of the lungs, and in several cases incapacitated from labour, are 27. Many are otherwise diseased, arising in a great measure from the direct influence of the occupation, and the peculiar circumstances in which they are placed. Of the 27, 20 are under 43 years of age.

In a previous part of this inquiry, we have remarked that the position of the grinder is particularly detrimental to health, and must be taken into consideration in comparing one branch with another, as the position is modified in degree in each, according to the size of the article which is ground and the labour bestowed upon it. The smaller the article, the more inclined is the body over the stone; and the more elaborate the workmanship bestowed upon it, the less frequently is this position relieved. In the grinding of pen-knives and razors, the inclination of the body forward is greater than in any other branch; hence, while

less injurious, in regard to the amount of dust evolved, than the fork and needle branches, they are fraught with greater evil from the position of the body alone.

The artisans in the well-paid branches are invariably the best educated, and exhibit in their conduct a higher tone of morality. Poverty and ignorance always co-exist; hence the rate of wages and the fluctuations to which it is subject, are facts which unerringly indicate the prevailing intelligence of any class. When the attention of the mind is engrossed by the urgent wants of the body, there is neither the desire nor the occasion to acquire knowledge.

The power to read and write is a valuable attainment. It opens sources of gratification that otherwise would be unenjoyed, and places within reach the elements of excellence and distinction. We cannot, however, forego the expression of an opinion which we have long entertained, that an exaggerated degree of civilization or intellectual progress is inferred from the possession of this power. It is viewed too much as evidence of education than as a means towards it. The wide, and by far the most important field,—the emotions which may be awakened to the perception of virtue, or the beauties of external nature, is often left uncultivated, as if fraught with no interest, or barren of beneficial results. Indeed, the tendency of the age is material, not spiritual. The struggle is for wealth, and the mind is trained to regard it as the most valuable of all objects; and taught to pursue it as the aim and end of existence, and not as a means of enjoyment.

The degree of education possessed by the pen-blade grinders is superior to that of the fork-grinders; it is, however, low compared with that of the artisans in perfect union. Among the 319 adult workmen, there are 75 that cannot read, and 21 that can read but cannot write. The number of apprentices is 215; of whom 33 cannot read, and 14 can read but cannot write.

SECT. VI.—*Table-Knife Grinders.*

The branch which we propose next to examine is by far the most extensive of any of the grinding departments in this town, and,

on various considerations, is worthy of attention. Table-knives are almost entirely ground on a wet stone; the artisans, however, are much more frequently mixed with dry-grinders, than those of any other wet branch, and from this circumstance, that in the grinding of saws, scythes, sickles, and heavy edge-tools, in which the wet stone is extensively used, the articles from their size require a large stone, and this is generally moved by water and not by steam power, and the grinding is generally pursued in the country. Small stones, on which dry grinding is performed, are seldom found in the same wheel with the large ones; hence the grinders who employ the latter, are not usually exposed to the clouds of dust created by others. Table-knives, not requiring a large stone, are ground indiscriminately in the same room with the smaller articles of cutlery, consequently the artisans in this branch will be more or less exposed to the dust of dry-grinders. This is an important circumstance, as it occasions results different from what would otherwise be observed, were the occupation pursued apart from dry-grinding. We have already remarked, that the smaller the article, the more inclined is the position of the body over the stone. This inclination is much greater in the grinding of table-knives, than in that of saws, scythes, sickles, and other edge-tools, and we should therefore calculate on modifications in the amount of disease and in the rate of mortality, compared with the other branches of wet-grinding, in which the articles are large. In the latter, the body is much less bent and its position is varied every few minutes. The condition of the table-knife grinders is, in regard to health and longevity, intermediate between the most deleterious and the least pernicious branches; and this will be evident from subsequent inquiries.

In the following returns we give the country grinders in one table, and the town grinders in another, as they present some differences not unworthy of notice. It must not, however, be imagined that the former invariably reside in the country. The inducement to pursue the occupation there, arises from the greater cheapness of wheel-room; water-power being always cheaper than steam-power. The number of country grinders is about 196. We have particulars of 188, which are as follows:—

Ages.	Persons.
21 to 25	45
26 „ 30	32
31 „ 35	31
36 „ 40	17
41 „ 45	24
46 „ 50	18
51 „ 55	9
56 „ 60	10
61 „ 65	0
66 „ 70	1
71 „ 75	1

 188

The town grinders are 282; we have particulars of 275:—

Ages.	Persons.
21 to 25	80
26 „ 30	60
31 „ 35	35
36 „ 40	32
41 „ 45	23
46 „ 50	21
51 „ 55	13
56 „ 60	7
61 „ 65	1
66 „ 70	2
71 „ 75	1

 275

Of the 463 town and country table-knife grinders, twenty-six have been several years in the army or navy, or otherwise employed:—

Ages.	Persons.
30 to 40	4
41 „ 45	6
46 „ 50	3
51 „ 55	6
56 „ 60	3
66 „ 74	4

 26

The following are the ages at which the country grinders were put to work:—

At and under	Ages.	Persons.
	9	30
	at 11	63
	„ 12	31
	„ 13	31
	„ 14	11
	„ 15	2
	„ 16	2
	„ 17	1
	„ 18	1

 172

We have similar returns of the grinders working in the town, which are as follows :—

	Ages.	Persons.
At and under	9	62
	at 11	86
	„ 12	51
	„ 13	34
	„ 14	27
	„ 15	4
		<hr/>
		264

From these returns, it appears that a much greater proportion of the town grinders are put to work at nine years of age, or under, than of the country grinders, which we presume is evidence of an inferiority in the condition of the former. Of the fact there is no question. It is lamentable to observe that nearly one-fourth of the 463 entered upon the occupation at nine years of age or under; indeed, many of them were only seven and eight years old. While such is the practice, it is in vain to expect any great improvement in the physical and moral condition of this class of artisans. The number of apprentices in this branch is 258, and having procured the ages at which they began to work, we have an opportunity of ascertaining whether the accumulation of national wealth has been accompanied with a proportionate amelioration of this evil, which imperatively demands the interference of the legislature.

	Ages.	Persons.
At or under	9	40
	at 11	92
	„ 12	74
	„ 13	29
	„ 14	15
	„ 15	4
	„ 16	1
		<hr/>
		255

We regret that the comparison presents no improvement. In the country and town grinders, and in the apprentices belonging to both, more than half began the business at or under 11 years of age.

We now proceed to show the proportion of this class of grinders married, and at what ages.

COUNTRY GRINDERS.

Ages.	Persons.
Under 21	48
21 to 25	73
26 „ 30	13
31 „ 35	2
	<hr/>
	136

TOWN GRINDERS.

Ages.	Persons.
Under 21	99
21 to 25	89
26 „ 30	18
31 „ 35	3
36 „ 40	2
41 „ 45	1
	<hr/>
	212

Thus, of the 463, 348 are married, concerning which number we have particulars. More than half of the town grinders are married at 21 years of age or under; whereas, of the country grinders, only 48 of the 136. The shop girls married by the 136 country grinders were 4; by the 212 town grinders, 47. We perceive in these returns a difference in the condition of these two classes of grinders, and such would be anticipated from the different circumstances in which they are placed.

The number of children born to both classes exceeds any of the preceding returns; and this perhaps arises from the table-knife grinders living to a greater age than the artisans in the other branches. It is clear, that if a much greater proportion of the grinders, in one branch, live to 30 or 40 years of age, than in another, a corresponding difference will be observed in the number of children born. This circumstance will unquestionably greatly modify the results; there may, however, be other causes concurring with it, which it is not in our power satisfactorily to analyze.

The number of children born to the country grinders is 746. The living are 520; the dead, 226. The children born to the town grinders are 865. The living are 561; the dead, 304. The married of the country grinders are 136; of the town, 212. We observe a great difference in the number of children born to these two classes, and also in the rate of mortality: 136 marriages of the former have produced 746 children; 212 of the latter, 865.

The deaths in the 746 are 226; in the 865, 304. In the preceding returns of the ages of the country and town grinders, the average of the former, above 36 years of age, exceeds that of the latter by about 10 per cent., which, as already remarked, is a circumstance that will modify the proportion of births to each individual. It is not difficult to account for the greater mortality in the one case than in the other. The mortality of children in all manufacturing towns is always much greater than in the country.

The grinders in this branch, until the last two years, were in union; and during the protracted period of commercial distress, from 1836 to 1840, paid to the artisans out of employment, to prevent their competing at reduced prices, for the diminished amount of work, above L.15,000. The increased demands upon the funds at length broke the union, since which the wages of labour have been quite inadequate to purchase the common necessities of life; and the condition of the artisans, at this moment, is wretched in the extreme.¹

The adult grinders in the branch are 478; we have particulars, however, only of 463. Among this number, 40 are suffering from diseases of the lungs, attended with cough, difficulty of breathing, and expectoration; 8 of inflammation of the lungs; 9 of spitting of blood; 16 of rheumatism; 3 of fever; and 16 of various diseases, such as affections of the heart and large vessels, of the nervous system, and of the urinary and digestive organs. In some cases, the spitting of blood is associated with manifest inflammation of the lungs; in others, it has attacked the individual suddenly, without having been preceded by much cough or difficulty of breathing; indeed, occasionally the patient denies having had either. The rheumatic cases are mostly chronic, and the muscles of the back and loins are more frequently affected than any other. Many of the individuals suffering from these diseases

¹ The manufacturers in this town are opposed to the unions of workmen. It is, however, remarkable that, within the last six weeks, many of the most respectable and influential have assisted the men in this branch, in the re-construction of their union; finding that otherwise they will themselves be shut out of all markets, by the competition of the small manufacturers, who are one degree only above the condition of artisans. The *journeymen-manufacturers*, when men are not in union, by working themselves, and by means of apprentices, can greatly undersell the respectable manufacturers; the latter always paying a higher price than the former.

are incapacitated from labour, and have been so for a considerable time.

In order to complete the picture of the condition of this important branch, we have obtained the number of deaths since 1835, and also a statement of the nature of the diseases of which the grinders have died. The deaths, of which we have particulars, are 102; and as there is a marked difference in the mortality, between the town and country grinders, we shall give the returns of each separately.

AGES at which the Country Grinders have died.

Ages.		Deaths.
Under	21	1
21	to 25	3
26	„ 30	4
31	„ 35	2
36	„ 40	6
41	„ 45	6
46	„ 50	6
51	„ 55	7
56	„ 60	8
61	„ 65	3
66	„ 70	3
	85	1
		—
		50

AGES at which the Town Grinders have died.

Ages.		Deaths.
Under	21	4
21	to 25	2
26	„ 30	4
31	„ 35	5
36	„ 40	14
41	„ 45	7
46	„ 50	13
51	„ 55	1
56	„ 60	2
		—
		52

Of the 50 deaths of the country grinders, 22 are recorded above 50 years of age; of the town grinders only 3; whence it may be inferred, that the rate of mortality is much greater in the latter than in the former. This conclusion would certainly be very obvious were the town and the country grinders equal in numbers, which, in the preceding returns, is shown not to be the case. We do not know what the proportions were between the two in 1835; but we are inclined to believe, that the proportion of the country grinders has gradually been decreasing for years,

in consequence of the greater convenience of grinding in the town, where the articles are manufactured.

Among the country grinders, 34 have died of diseases of the lungs; 4 of decay of nature; 3 of inflammation; 2 of rupture of blood-vessels; and 7 of other complaints. Of the town grinders, 37 have died of diseases of the lungs; 2 of decay of nature; 8 of rupture of blood-vessels, or the breaking of stones; and 5 of other diseases. These returns do not possess all the accuracy which is desirable in investigations of this kind. The parties who have recorded the diseases were guided entirely by the *prominent* symptoms which presented themselves. In the returns, a distinction is made between cases of consumption and those of the grinders' disease, which we have not retained, though occasionally it may be perfectly just: we have included both under the head of diseases of the lungs. Had these cases been minutely examined, we have no doubt, from our own extended observation, that the pulmonary affection would have been found complicated, in many instances, with disease of the heart, of the large arteries in the chest, or of the liver. We regret that it has not been in our power to furnish more precise information concerning the causes of death. The labour has been great in the endeavour to obtain these general facts.

SECT. VII.—*Saw-Grinders.*

We enter with pleasure on the inquiry into this and the following branches, which afford a striking and pleasing contrast to the branches already considered. We have here far superior physical powers, greater intelligence, better remuneration, and considerably less disease than will be found in any other body of grinders. The men in general exhibit strong and well developed muscular frames; many of them are fine specimens of an athletic race. Several causes concur in the production of these effects. A large proportion of the workmen are born and brought up in the country, and follow agricultural pursuits as well as grinding, not only in early life, but afterwards. This combination of the two employments arises, in part, from saw-grinding being principally carried on in the country, in water-wheels, and not in

wheels where the propelling power is steam ; consequently, when the water is either too abundant or deficient, the workmen have frequently whole days of leisure ; hence the advantage, on these occasions, of having small farms, or plots of ground to cultivate. Further, boys of tender age or constitution would be unequal to the labour in this branch, and therefore they are not admitted. The employment itself is not injurious to health, but, on the contrary, tends to invigorate the frame. The position of the grinder at work is nearly upright, not bent double on his chest, with his face a few inches from the stone, as in the fork, the razor, the pen-knife, or the scissor branch ; and the heavy and bulky article which he grinds brings into play the greater part of the muscular system. Another important advantage which he has over the rest of the grinders, is that he constantly uses the wet stone, so that he is not exposed to the influence of the greatest of all evils in connexion with grinding,—the clouds of poisonous dust.

In former times all grinding was carried on in water-wheels, and the workmen then were not, what they are now, poor, emaciated, miserable objects, nor were they peculiarly subject to the disease which at present is so destructive to life. Then, the grinder either lived in the country, or had the benefit of several miles' walk from the town to his work ; and the rooms in water-wheels were always well ventilated by broken windows, or often by the absence of them, and roofs in a wretched condition ; and at that time dry grinding was almost unknown.

The application of steam instead of water power, has entirely revolutionised the habits of the grinder. With few exceptions, he is a resident in the town, and works in rooms, the windows of which are well glazed and the roofs in excellent repair. In studying to secure warmth and comfort, he has created and confined one of the most destructive agents found in association with manufactures. It is under these circumstances that dry grinding has sprung up. As would naturally be supposed, it facilitates the abrasion of the metallic surface much more readily than the wet process.

It will be seen, by the following facts, how much more healthy is the saw-grinding branch, than any other which we have ex-

amined. The number of adult workmen in it, of whose ages we have particulars, is 78:*

Ages.	Persons.
21 to 25	12
26 „ 30	17
31 „ 35	9
36 „ 40	10
41 „ 45	11
46 „ 50	5
51 „ 55	5
56 „ 60 }	9
61 „ 65 }	

How different is this picture from the foregoing facts presented! Among 33 of the needle-grinders, 5 only are above 30 years of age, and the average of the ages at which they began the business is rather more than 23 years. Among the saw-grinders, 49 of the 78 are above 30 years of age, and actually 9 above 56. The circumstances influencing the health of these two classes of men must be very unlike.

The ages of the deceased in the branch offer to our notice the same favourable facts. Below are the deaths of 42 since 1821, and the ages of 40 are given:—

Ages.	Deaths.
21 to 25	3
26 „ 30	3
31 „ 35	0
36 „ 40	3
41 „ 45	3
46 „ 50	8
51 „ 55	6
56 „ 60	9
61 „ 65	3
66 „ 70	1
1 at 79	1
Ages unknown,	2
	—
	42

Among the scissor-grinders, of the 102 deaths, 67 were under 40 years of age, but in this branch, 9 only of the 40. It is also worthy of remark, that among the saw-grinders, 3 only have been in the army or navy. It is therefore evident, that the better educated and the more comfortable the members of a branch, from regular employment and a fair remuneration for labour, the less tendency there is to dissipation and vicious indulgences.

* There are about 12 not included in this number, of whom we have no particulars.

The saw-grinders are peculiarly liable to accidents from the breaking of stones and from becoming entangled in the machinery. This arises from two circumstances, the largeness of the stones on which they work, as well as the great length and weight of many of the articles which they grind. The larger the stones, combined with the rate of motion, the more liable they are to break; and it is manifest that a saw, five or six feet in length, is much less under the command of the grinder than a pen-knife; hence greater the chance of becoming entangled in the machinery. Of the 42 deceased, 5 were killed by the breaking of stones; and the following are a part of the accidents which have happened to the 78 *living* members:—

- No. 1. Lame 9 months from the breaking of a stone.
2. Lame 6 months; drawn over the stone.
3. Arm broken, from being entangled in the machinery.
4. Skull severely fractured; was incapable of work for 9 months; and the individual has broken 11 stones.
5. Drawn over the stone; severely hurt, in bed 9 months.
6. Severely hurt, confined 2 months; has broken 7 stones.
7. Hand cut; confined 1 month.
8. Leg entangled in the machinery; for 12 months unable to work.
9. Arm severely lacerated; lame 3 months.
10. Lamed from the stone breaking; ill 3 months.
11. Hand lacerated; incapacitated from work.
12. Hand lacerated; lame 2 months.
13. Leg broken, and now a cripple.

In this branch there are only four affected with the disease peculiar to grinders, and these cases are more likely to have arisen from exposure to wet and cold, than from inhalation of dust. There is no branch of grinders equally well remunerated, or a body equally intelligent. In some of the preceding returns, in which it is stated that so many can read and write, the ability to do either, with few exceptions, is of the most *humble* character, and we have no doubt that the number is exaggerated. The individuals, when interrogated on the subject, were unwilling to confess their ignorance; hence the answers were not always to be depended upon. Such inquiries respecting the saw-grinders were easy and satisfactory.

Of the 78 adults, 53 can read and write; 3 can read only; so that there are 22 that can neither read nor write. The apprentices in the branch are 46: between the ages of 10 and 15, 3; between 15 and 21, 43. Of the 46 apprentices, 36 can both read and write. These results are very different from any that we have contemplated in the several grinding branches. They indicate an easy command of the necessities of life; for where there is much physical suffering, either from disease or laborious exertions insufficiently remunerated, the cultivation of the mind is always proportionately neglected. The ages of the apprentices suggest a remark, the same as we made on the apprentices in the scissor branch. The prosperity of 1834, 1835, and 1836 had a marked influence on the introduction of boys. Of the 46, 43 are between the ages of 15 and 21, the greater part of whom would be admitted at that time, as well as some of the 12 between 21 and 25 years of age. Such are the effects of fits of prosperity inseparable from commercial enterprise.

We have further particulars of 67 of the 78; and it is somewhat singular, that with one exception, they are all married, and were married at the following ages:—At 21 and under, 34; from 21 to 25, 26; from 25 to 30, 6; total, 66. The number of children born to the 66 is 311, of whom 142 are dead. The artisans who have married shop-girls are only 7. The workmen in this branch are not peculiarly subject to diseases of the lungs. The occupation is not detrimental to health, except from the severity of the labour, and, as we have already remarked, the circumstances in which they are placed are exceedingly favourable to the development of the muscular frame. This class of grinders is the best remunerated, and the most vigorous in constitution of any engaged in the trade, and it affords a striking contrast to several of the branches which have been investigated. This branch has long been in a union, which is strictly maintained.

SECT. VIII.—*File-Grinders.*

In the consideration of this and the following branch, we regret that we have not the same particulars to present as those

which have been brought under notice, in connection with the preceding departments of grinding. The workmen in each branch are in perfect union or combination, and they regard researches into their condition with suspicion and distrust. File-grinding is done entirely on a wet stone; hence the artisans are not exposed to the injurious influence of dust, except what is produced by dry-grinders in the same room. It is scarcely necessary to remark, that the file trade is one of the most extensive staple manufactures of the town, and gives employment to a great number of hands. The file-grinders are 150, and of the following ages :—

Ages.	Persons.
21 to 25	65
26 to 30	24
31 to 35	39
36 to 40	10
41 to 45	7
46 to 50	2
51 to 55	2
56 to 60	1

The apprentices are 91: 19 between the ages of 10 and 15; 72 between 15 and 21. The men that can read and write are 60; that can read only, 32; so that 58 are incapable of doing either. The boys that can read and write are 30; those that can read only, 14; hence 47 incapable of either. From these facts it is evident, that the rising generation in the branch possesses less education than the existing adults. Among the 150 workmen, 6 have been in the army and navy, and 10 have been engaged for several years in agricultural pursuits.

We have the returns of 24 deaths in this branch since 1830.

Ages.	Deaths.
21 to 25	4
35 to 40	14
41 to 45	6

Many of the file-grinders work in the country, and from the union, which they strictly maintain, secure excellent wages. We have no particulars concerning their physical condition, the proportion married, and at what ages; nor of the number of offspring living and dead. The workmen are generally much more healthy and robust in constitution than the grinders in the preceding branches, with the exception of the saw-grinders, to whom

they approximate the nearest in physical condition, and in the rate of remuneration.

SECT. IX.—*Scythe-Grinders.*

Our information respecting this class of artisans, as in the foregoing branch, is exceedingly limited. Scythes are entirely ground on a wet stone. The occupation is laborious and requires considerable bodily vigour; it is not, however, injurious to health. This class of grinders generally both live and work in the country, consequently, are free from the influence of many circumstances which are detrimental to the physical condition of grinders employed and living in the town. The scythe-grinders are in union, and one which strictly keeps up the wages of labour. They are a fine healthy class of men, and have abundant means for securing the rational enjoyments of life. The number of grinders is 30, and of the following ages:—

Ages.	Persons.
21 to 25	6
26 to 30	8
31 to 35	6
36 to 40	2
41 to 45	5
46 to 50	2
56 to 60	1

The number of boys from 15 to 21, is 10. All the workmen and apprentices can both read and write. We have returns of 20 deaths within the last 15 years.

Ages.	Deaths.
21 to 25	1
35 to 40	2
41 to 45	5
46 to 50	5
51 to 55	4
56 to 60	3

Within the same period, 5 have been killed by the breaking of the stones on which they work. The artisans in this branch are liable to such accidents, from the largeness of the stones which they use. The few facts which are here given present a favourable condition of this class of grinders. They are better educated, and live much longer than the workmen in the branches previously considered, with the exception of the saw-grinders.

It is now time to terminate these investigations into the condition of the several grinding branches. They have occupied much of our attention for several years, and nothing but the strongest conviction of the importance of the labour would have induced us to persevere. The exposition of the evils has been regarded as a public duty, and has been performed, not unopposed by difficulties, a large proportion, we regret to say, arising from the prejudices of the men themselves, whose condition it is our desire to ameliorate.

The branches we have examined present great diversity in the circumstances of the grinders,—in their physical and intellectual condition,—in the scale of remuneration and the steadiness of employment,—in the amount of disease and suffering to which they are subject,—and, lastly, in the rate of mortality. In researches of this kind, there are difficulties which prevent the attainment of precise and accurate information on several interesting matters, arising not only from the prejudices of the artisans, but from the extensive and complicated nature of the inquiries, to render which complete in every respect, would demand more time than can possibly be spared from ordinary professional pursuits.

From the numerous facts which are here recorded, it will not appear strange that the rate of mortality should be exceedingly high in manufacturing districts; viewed, however, in the aggregate, it is no just indication of the suffering by which it is caused, nor does it throw any light on the average duration of life amongst the artisans. The rate embodies the result of two extremes,—that which belongs to the gentry and professional persons, and that which is peculiar to the labouring classes, which is by far the highest; and the effect of the two is considerably altered by the rate attaching to the middle or trading class. These rates vary considerably from one another in populous manufacturing communities, and seem to bear no uniform relation to the general average.

The conclusions flowing from the preceding inquiries, especially on the subject of mortality, are in accordance with the views of others, whose attention has been directed to such researches. The degree of ignorance existing in any class of artisans, is a general measure of the rate of mortality, leaving out of considera-

tion the influence of circumstances connected with particular occupations. In comparing, indeed, the different branches of the same trade, as the several divisions of grinding, we observe the strictest correspondence between intelligence and the duration of life; and the higher and more steady, the remuneration, the more independent, moral, and respectable are the individuals. This doctrine, we are aware, is opposed by some manufacturers, and if tested by facts within their own limited sphere of observation, perhaps justly. We conceive them to err, in comparing persons not placed in the same general circumstances. Take any branch, and compare the members of it, with respect to intelligence, sobriety, and morality, and we are certain that the rate of remuneration will be a fair measure of these qualities. This is the conclusion at which we have arrived after long and laborious investigations, pursued with the desire of discovering facts, uninfluenced by any preconceived views or prejudices.

The mode in which ignorance operates is various. It maintains a grovelling position in society,—it imparts no stirring impulse to the mind, tending to enlarge the sphere of reflection. The individual has few resources beyond the gratification of his appetites; hence he becomes the slave of them. The recklessness of his conduct leads to early marriages and their numerous consequences. Had the understanding been stored with a greater variety of thought, the course of action would have been modified, suggestions would have presented themselves, expanding the field of observation, and clothing a diversity of objects with interest, which are altogether unperceived and unfelt in a state of comparative intellectual darkness.

